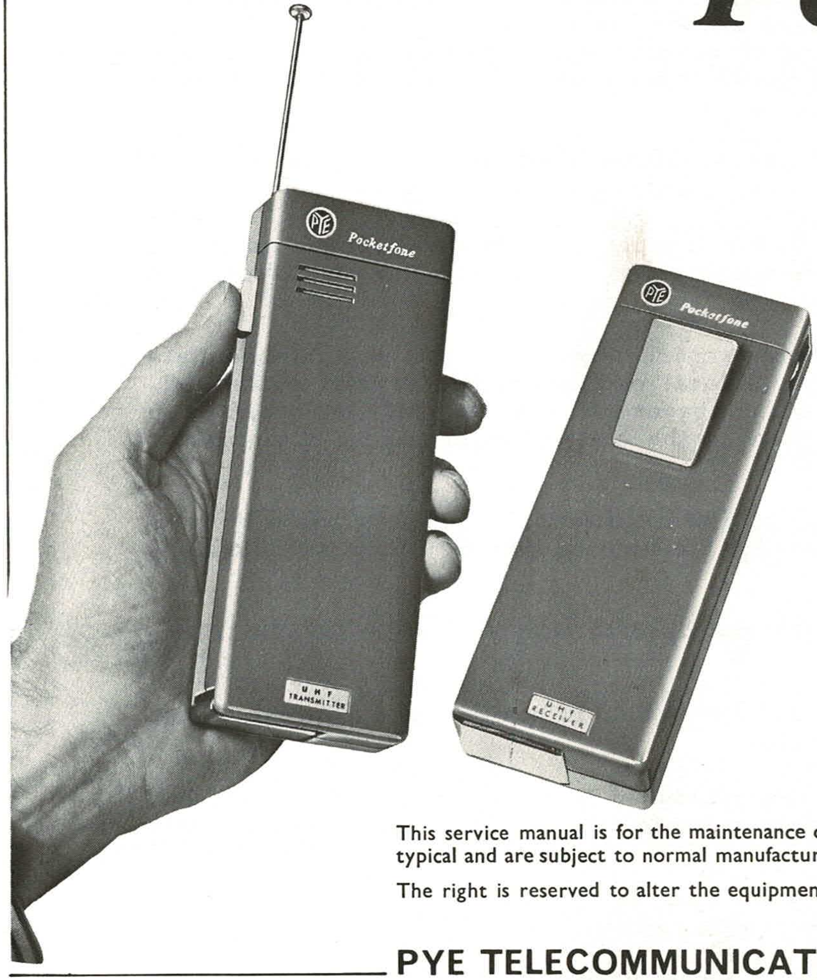
Pocketfone

Type PF1



This service manual is for the maintenance of Pye Telecommunications equipment. The performance figures quoted are typical and are subject to normal manufacturing and service tolerances.

The right is reserved to alter the equipment described in this manual in the light of future technical development.

PYE TELECOMMUNICATIONS LIMITED · CAMBRIDGE · ENGLAND

GENERAL DESCRIPTION

The Pye Pocketfone is a frequency modulated miniature radiotelephone designed to provide communication from person to base station, or person to person via the base station on 'talk through'. The range of up to several miles in built up areas is considerably increased when the equipment is used in open country. Direct person to person operation is also possible over short distances.

The equipment operates at preset fixed frequencies within the u.h.f. band of 450 to 470 Mc/s in two frequency working with a channel spacing of 25 or 50 kc/s

Both the fully transistorised transmitter and receiver units have a single operating control and are self-contained in separate tough plastic cases with built in antenna and battery supply.

The sensitive receiver employs a double superheterodyne circuit with intermediate frequencies of 10.7 Mc/s and 100 kc/s; both local oscillators are crystal controlled. A squelch circuit silences the receiver in the absence of a signal and also operates an economiser circuit which considerably reduces the battery drain during listening out periods.

The transmitter has a nominal output of 100 milliwatts. This unit has a built-in microphone and is fitted with a 6 inch retractable antenna which automatically extends when the press-to-talk switch is operated.

Rechargeable nickel cadmium batteries are used to supply 18 volts for the transmitter and 9 volts for the receiver.

The receiver unit fits in the breast pocket and is held in position by a clip; the transmitter unit is normally stowed in a side pocket.

The Pye Pocketfone is designed and manufactured to stringent specifications, has innumerable applications and is particularly suitable for use by the police and security forces.

RECEIVER UNIT

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SUMMARY OF DATA

Service	F3 Telephony Two frequency working
Frequency range	450-470 Mc/s
Channel spacing	25 or 50 kc/s.
Power supply	One 9 volt battery (Yellow)
Battery type	Rechargeable nickel cadmium battery.
Sensitivity	1μV p.d. for 20db quieting
Audio output	60mW
Intermediate frequencies	1st i.f. 10.7 Mc/s 2nd i.f. 100 kc/s
Squelch	Preset
Battery switching circuit	ON 60 msecs OFF 600 msecs (no signal)
Battery endurance	20 hrs. (nominal)
Control	Combined ON/OFF and VOLUME
Antenna	Concealed dipole
Dimensions	$6\frac{3}{8}''$ x $2\frac{5}{16}''$ x $1\frac{1}{8}$ in. (17 x 5.85 x 2.85 cm)
Weights	Less batteries $9\frac{1}{2}$ oz (268 gm) With batteries 11 oz (312 gm)

OPERATING INSTRUCTIONS

The Pye Pocketfone receiver unit is supplied preset to the required operating frequency.

IMPORTANT

Switch off the receiver before attempting to install the battery.

Holding the receiver unit with the base uppermost raise the battery door. Insert the 9V battery (yellow) into the storage chamber and then close the battery door.

Check the operation of the receiver in conjunction with the base station.

Note: The operation of the transistor switch in the battery economiser circuit produces a soft audible click from the loudspeaker. This will cease on receiving a signal.

FIELD TESTING PROCEDURE

To check the operating frequency against that of the base station carry out the following procedure.

1. Carry out operations 1, 2 and 3 of 'Dismantling Procedure'. Replace battery and switch on.
2. Arrange for the base station to radiate a carrier.
3. Switch on a 10.7 Mc/s marker oscillator unit (the Pye PT501 is suitable) and hold it close to the Pocketfone receiver first i.f. section.
4. If a high audio beat note is produced, the Pocketfone receiver crystal trimmer L2 (accessible through screening can) should be adjusted for zero beat.

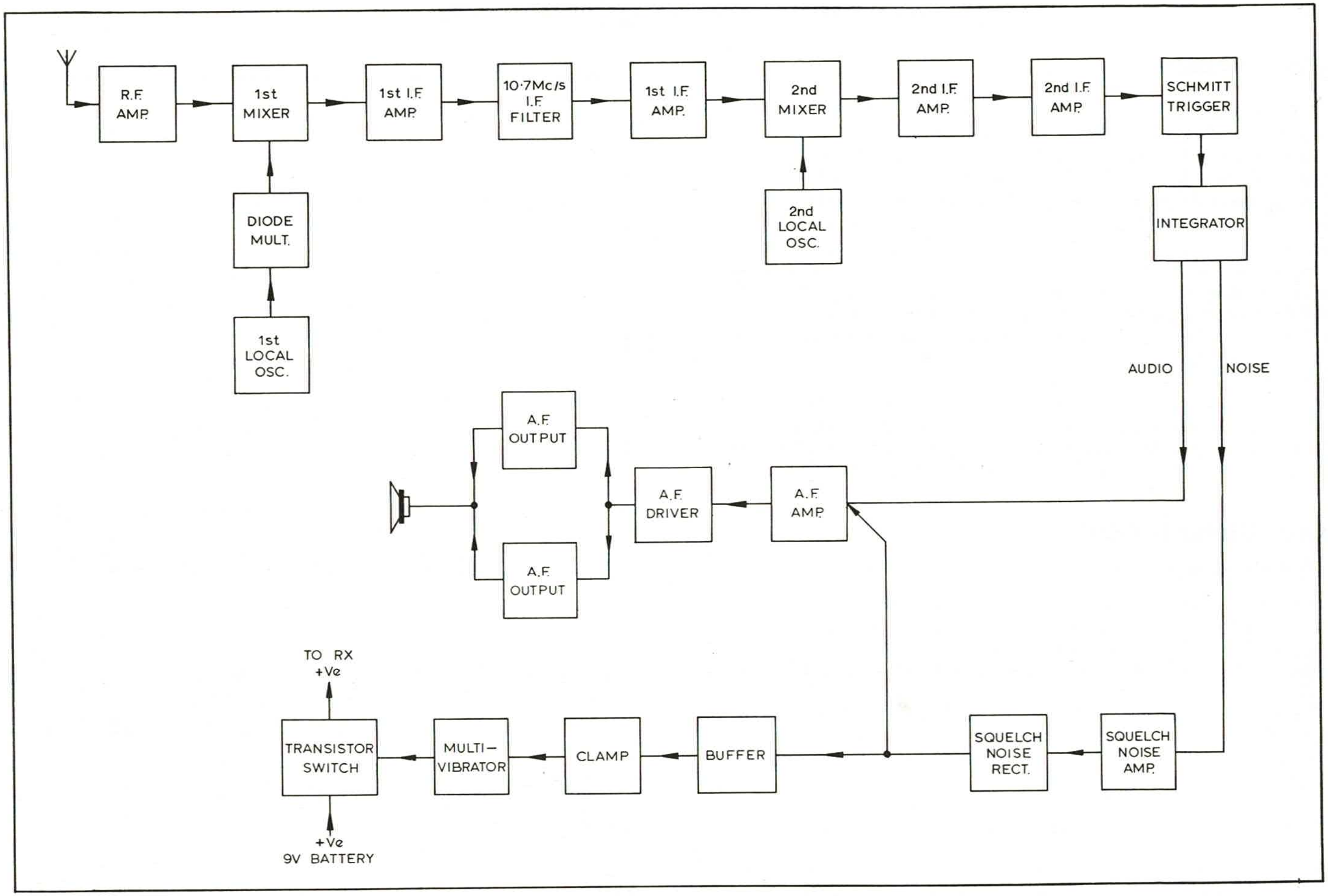


Fig. 1 Receiver Block Diagram

RECEIVER CIRCUIT DESCRIPTION

CIRCUIT SUMMARY

The transistorised receiver employs a double superheterodyne circuit. The r.f. amplifier is followed by the first mixer fed from the first local oscillator giving a first i.f. of 10.7 Mc/s. After amplification the first i.f. is passed through the 10.7 Mc/s crystal filter unit and then further amplified in a single tuned stage before application to the second local oscillator and mixer. The resultant second i.f. at 100 kc/s is amplified in two resistance capacity coupled stages before being applied to the Schmitt trigger circuit. The resultant square wave output at a pulse repetition frequency equivalent to the frequency deviation of the received signal is shaped into a trigger pulse and passed to the integrator circuit. After filtering out the 100 kc/s component, the audio signal, with de-emphasis, is fed via the a.f. stages to the loudspeaker. An economiser circuit operated by the noise content in the absence of a signal considerably reduces the battery drain.

CIRCUIT DESCRIPTION

R.F. Section

The incoming u.h.f. signal from the built in antenna is connected to the antenna input circuit comprising L1 tuned by C2. TR1 is a conventional r.f. amplifier with a double tuned transformer T1 in the collector load.

The u.h.f. signal applied to the first mixer TR2 is combined with the output from the first local oscillator TR3 and multiplier circuit to produce the first i.f. of 10.7 Mc/s.

TR3 is an overtone crystal controlled oscillator provided with inductive crystal-trimming; the output at the collector of TR3 is fed to the diode multiplier circuit. The cathode circuit of D1, consisting of L5 tuned by C18, selects the fifth harmonic which is the first mixer injection frequency of 10.7 Mc/s below the carrier frequency.

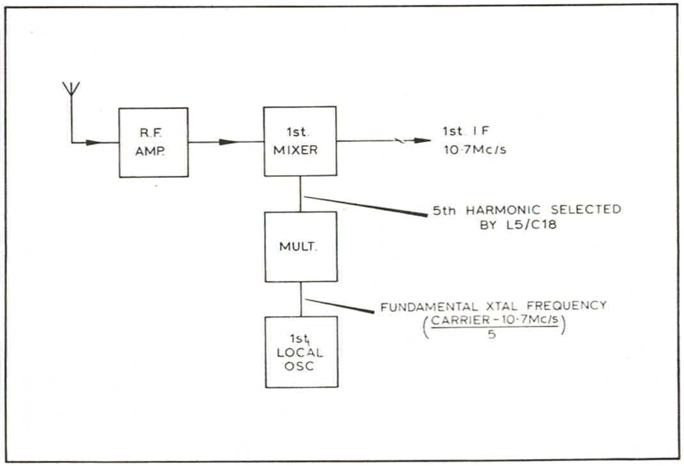


Fig. 2 R.F. Section Block Diagram

Carrier	450-470 Mc/s
Xtal Frequency	$\frac{\text{Carrier - 10.7 Mc/s}}{5}$
Harmonic	Fifth
1st Local Osc.	Carrier - 10.7 Mc/s
1st I. F.	10.7 Mc/s

First I.F. Amplifier

The single tuned transformer T2 is used in the collector load of TR2 to reduce spurious signals and harmonics before the first i.f. signal is amplified by TR4.

The broad band signal output from TR4 is coupled by C22 to the input of the sealed 10.7 Mc/s crystal filter unit. This filter unit reduces the bandwidth of the 10.7 Mc/s signal which is then amplified by TR6 and coupled to the second mixer TR7 by the single tuned transformer T3.

Second Mixer

The output from the second local oscillator circuit at the emitter of TR5 is injected into the second mixer TR7 at the fundamental crystal frequency.

This frequency is normally 100 kc/s above the first i.f. of 10.7 Mc/s (i.e. 10.8 Mc/s) but will be 100 kc/s below the first i.f. (i.e. 10.6 Mc/s) when the receiver is operating at carrier frequencies within 100 kc/s of 453.6 Mc/s or 464.4 Mc/s.

The Receiver Second Local Oscillator Crystal Specification is P53J.

Second I.F. Amplifier

The output from the second mixer at the second i.f. of 100 kc/s is amplified in two resistance capacity coupled stages TR8 and TR9 and then applied to the Schmitt trigger circuit.

The limiter diodes D2 and D3 located in the base circuit of TR8 prevent overloading of the stage when a high signal level is present.

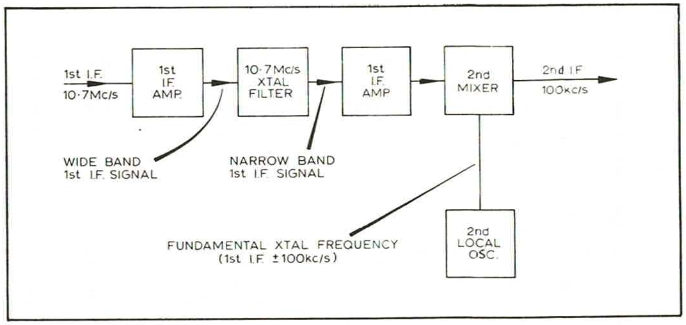

1st I.F.
10·7Mc/s
1st I.F. AMP.
10·7Mc/s XTAL FILTER
1st I.F. AMP
2nd MIXER
2nd I.F
100kc/s
WIDE BAND 1st I.F. SIGNAL
NARROW BAND 1st I.F. SIGNAL
FUNDAMENTAL XTAL FREQUENCY (1st I.F. ±100kc/s)
2nd LOCAL OSC.

Fig. 3 First I.F. and Second Mixer Block Diagram

Schmitt Trigger Circuit

The Schmitt trigger circuit consisting of TR10 and TR11, is operated by the incoming 100 kc/s signal. TR10 conducts on each half cycle and a square wave pulse of constant amplitude is produced at the collector of TR11 with a pulse repetition frequency equivalent to the frequency deviation of the incoming signal. The square wave pulse is then shaped by the differentiating circuit C44 and R41 to produce a triggering pulse for the integrator.

Integrator

When triggered TR12 produces a waveform, the sinusoidal content of which has an amplitude proportional to the time integral of the pulse input.

The output from the integrator is fed to a resistance capacity network of which C45, C46 and C47 filter out the 100 kc/s component, and R43, R45, R46 and C49 provide the required 6db de-emphasis characteristic of the a.f. signal.

Two outputs, noise and audio, are taken from the resistance capacity network.

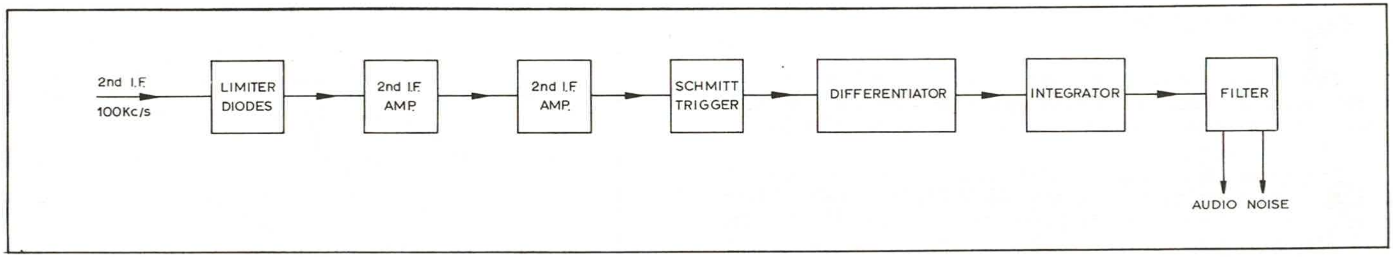


Fig. 4 2nd I.F., Schmitt Trigger and Integrator Block Diagram

Squelch Circuit

In the absence of a signal the noise content is applied to TR13, the noise amplifier, via C50.

The output from the noise amplifier causes the noise rectifier TR14 to bottom. With no forward bias TR15, the a.f. amplifier, is cut off and background noise is not heard in the loudspeaker (or earphone) When an incoming signal is received, the noise content falls, TR14 ceases to conduct and forward bias is now applied to TR15, which conducts.

The zener diode D4 provides d.c. stabilisation at the collector of the noise rectifier TR14 to compensate for variations in the supply voltage.

A.F. Section

The a.f. signal is passed to the base of TR15, the a.f. amplifier, via the VOLUME control RV1 and C56. After amplification the audio signal is coupled by C57 to the base of TR16, which acts as a driver stage for the output transistors TR17 (NPN) and TR18 (PNP). The NPN and PNP transistors conduct alternately to provide the push pull output which is coupled to the loudspeaker via C60.

An external jack socket JK1 is provided for plugging in the earphone, thereby automatically disconnecting the loudspeaker. This facility is intended for use when the receiver is employed in noisy surroundings or when private communication is required.

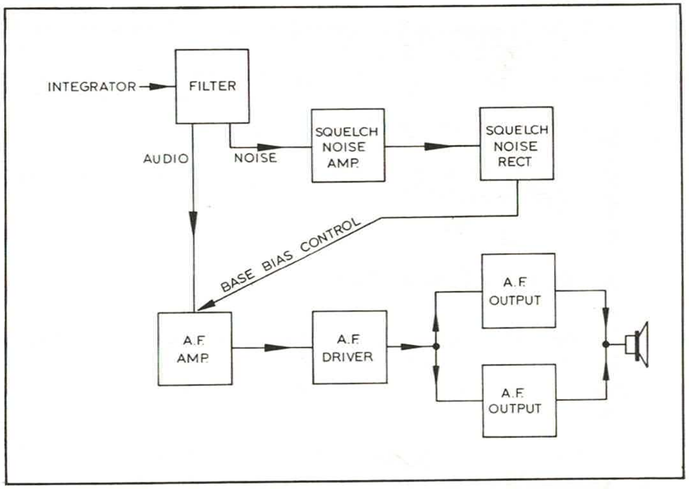


Fig. 5 Squelch and A.F. Section Block Diagram

Battery Economiser Circuit

Function

The battery supply is applied to the receiver only when the economiser circuit is in the ON condition.

In the absence of a signal the economiser circuit is alternately ON for 60 msecs and OFF for 600 msecs.

When a signal is received the economiser circuit is held at ON and maintained in this condition until approximately 2 seconds after the cessation of the received signal. This prevents the economiser circuit cycling between the ON and OFF conditions and allows for blind spot reception experienced at u. h. f. during movement in built up areas. Within this two second period the noise content operates the squelch circuit so that background noise is not heard in the loudspeaker.

Although there is a direct connection from the battery to the push pull a. f. output stage, its bias is obtained via the economiser circuit which disconnects the complete receiver supply when in the OFF condition.

Operation

The economiser circuit is connected in series with the positive supply line to the receiver.

When the receiver is switched on by the operation of switch SA, no forward bias is applied to the base of TR19 so that the buffer and clamp stages, TR19 and TR20 respectively, do not conduct.

The self starting multivibrator (flip flop) circuit, TR21 and TR22, operates with a time constant determined by C64, R70 and R72, and causes the transistor switch TR23 to connect the battery to the receiver circuit at a frequency of 60 msecs ON and 600 msecs OFF.

The transistor switch OFF for 600 msecs.

TR19	TR20	TR21	TR22	TR23	TR24
OFF	OFF	ON	OFF	OFF	OFF

With TR21 conducting and C64 charged up to approaching the full positive voltage, TR22 is cut off. No forward bias is applied to the base of TR23 which therefore does not conduct.

TR24 is also cut off as the base is clamped near to the negative line when TR21 is conducting.

The transistor switch is therefore in the OFF condition and the battery supply is not connected to the receiver circuit.

The transistor switch ON for 60 msecs.

TR19	TR20	TR21	TR22	TR23	TR24
OFF	OFF	OFF	ON	ON	OFF

C64 discharges via R72 and permits TR22 to conduct. With C64 discharged, the emitter of TR21 is driven positive and TR21 is cut off. C64 commences to charge via R70, TR22 and the emitter/base junction of TR23.

As the base of TR24 is forward biased, it conducts and provides a current path for TR23 which then bottoms. TR23 is held in the bottomed condition by a current path via TR22; TR24 takes no further part in this action and ceases to conduct.

TR23 conducts and connects the battery supply to the receiver circuit.

Receiver operating–no signal

With the receiver operating and in the absence of a signal, the noise content is amplified by TR13, and TR14 bottoms so that no forward bias is applied to the buffer stage TR19. Therefore the multivibrator continues to cycle at a frequency of 60 msecs ON and 600 msecs OFF.

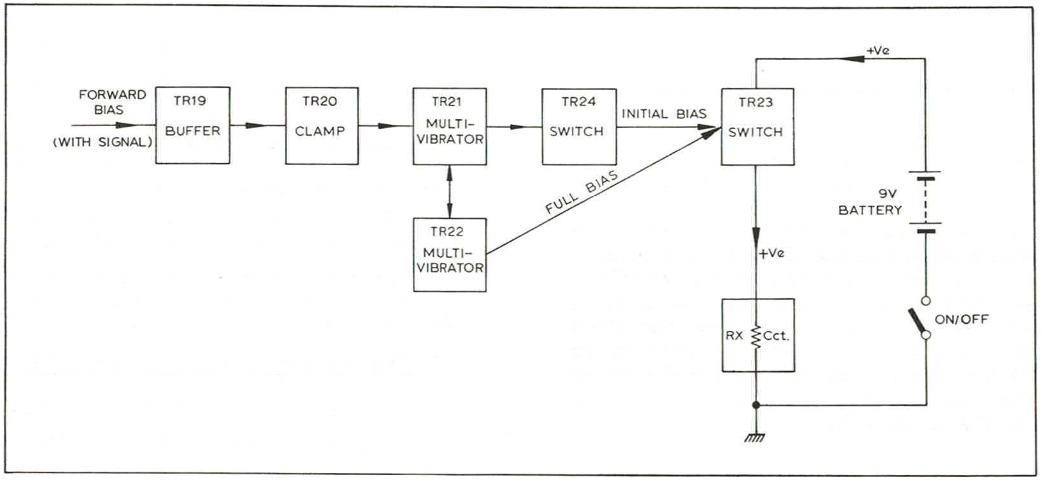


Fig. 6 Battery Economiser Block Diagram

Receiver operating – with signal

When a signal is received the noise content falls; the transistor switch connects the battery to the receiver and is held at ON.

TR19	TR20	TR21	TR22	TR23	TR24
ON	ON	OFF	ON	ON	OFF

If a signal is received during the 60 msecs ON period, the Schmitt trigger locks on to the received signal.

When the noise content falls, TR14 the noise rectifier, ceases to conduct and a forward bias derived from the potential divider R52, R53, R54 and R55 is applied to the base of the buffer TR19 via R63.

TR19 conducts and provides the base potential for TR20, the clamp stage, via the diode D5.

TR20 conducts and clamps the base of TR21, one half of the multivibrator circuit, to the negative line.

TR21 is held at cut off and TR22 conducts maintaining the full bias on the base of TR23, the transistor switch, which conducts and connects the battery to the receiver circuit.

TR23 is held ON until the noise content rises after the cessation of the received signal.

C63 maintains the economiser circuit in the ON condition for approximately 2 seconds after the rise in the noise content has caused TR14, the noise rectifier, to bottom and the forward bias applied to the buffer stage has been removed.

RECEIVER SERVICING

Introduction

Due to the high component density, great care must be taken when removing or servicing Pye Pocketfone printed circuit boards.

It will not normally be necessary to remove the receiver unit completely from its case to carry out the performance checks or alignment procedure. With the front cover removed, the receiver printed circuit board can be inverted 'in situ' for taking meter readings.

Dismantling Procedure

1. Ensure the receiver is switched off. Open the battery door and tilt the receiver until the battery slides out.
2. Remove the two 6 B.A. screws from the back cover.
3. Gently separate the two halves of the case and remove the front cover.
4. Remove the external locking nut securing the earphone socket to the back cover.
5. Carefully remove the printed circuit board assembly, complete with transducer (L. S.) and earphone socket, from the back cover.

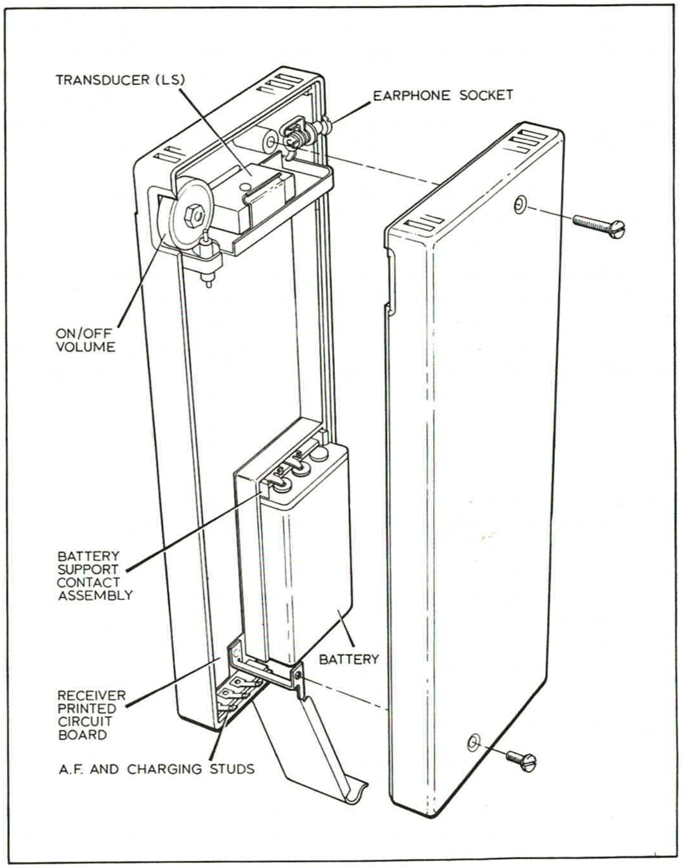


Fig. 7 Receiver Dismantling Diagram

Printed Circuits

When taking meter readings at appropriate points on the printed circuit board use needle point test probes. Use the minimum amount of force necessary when removing a faulty component. A recommended procedure is to cut the leads of the faulty components and holding the board upside down, apply the miniature soldering iron to the printed circuit board, thereby causing the end wires to fall out. A clean hot soldering iron must be used and soldering completed as quickly as possible to avoid damage caused by the softening of the adhesive under the printed circuit board.

Clean the end wires of the replacement component, insert through the holes in the board and then cut the end wires to length; should the holes be blocked with solder, a suction soldering iron, or suction pump may be used to assist in clearing the holes, and thereby avoid using excessive heat. Bend over against the printed circuit sufficient to hold the component in position and then complete soldering as rapidly as possible.

Plated through holes are used on the printed circuit board where components are connected to the negative line, thereby avoiding the soldering of component end wires to the top surface of the printed circuit board. The plated through holes are normally cleared by use of a suction soldering iron, but if this type of iron is not available carefully apply a miniature iron to the copper track surrounding the hole and insert a length of 26 s.w.g. enamelled copper wire to clear the hole.

Transistor Circuits

Transistors are susceptible to damage by current overload, reversed supply polarity or accidental short circuit. To avoid the risk of damage it is therefore advisable to use suitably insulated small test meter prods and crocodile clips.

As transistors are easily damaged when being removed, ensure that the transistor is faulty and not an associated component before removal.

TEST EQUIPMENT REQUIRED

1. Variable power supply unit giving hum-free d.c. supply (Solartron AS1164/2 or Farnell L20)
2. Multimeter of 20,000Ω/volt sensitivity (Avo Model 8).
3. Signal generator giving test signal of 10.7 Mc/s and 450-470 Mc/s. (Marconi TF 1064B/6 or TF 1066B/1)
4. A.F. oscillator with calibrated attenuator. (Marconi TF 1101)
5. General purpose oscilloscope.
6. H.F. valve voltmeter or diode probe (use circuit shown with 0-50μA meter, or Pye TM1).
7. 60Ω audio output meter (calibrated in db).
8. 10μF electrolytic capacitor and 0.1μF capacitor.
9. Trimming tools. (Part No. ET16450 & ET16451).
10. Pye PT.501 10.7 Mc/s Crystal Controlled Marker Oscillator.

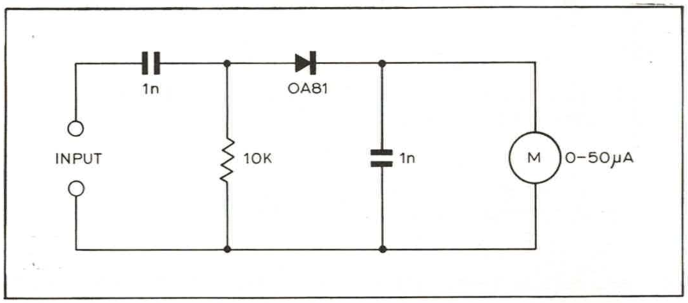


Fig. 8 Diode Probe

PRECAUTIONS

Before servicing the receiver carefully read the following notes:-

1. Ensure that the working area is clear of tools or pieces of wire which might cause an accidental short circuit.
2. Always check the supply polarity before switching on the receiver, as application of reverse supply polarity will destroy some transistors e.g. TR17 and TR23.
3. If the emitter circuit of TR23 is momentarily connected to the negative line, the transistor will be destroyed.
4. After retuning an air spaced trimmer (C2, C6 and C11) seal the trimmer with locking dope.
5. If any nuts are tightened they should be sealed with locking varnish.
6. It is essential that the audio leads connected to the jack socket are dressed away from the antenna, to avoid detuning effects.
7. Protect the battery connections and jack socket connections with insulating tape.
8. Ground potentials, which may exist between the soldering iron and test equipment or between different pieces of test equipment, can result in the unintentional application of damaging potentials to transistor electrodes. It is essential to ensure that all test equipment is adequately grounded and it is advisable to disconnect all test equipment from the receiver before soldering.
9. Component failures may be caused by the use of excessive heat during soldering. Ensure that the surfaces to be soldered are clean before applying a clean soldering iron which has a small or pointed bit. Apply the minimum of heat consistent with making a good connection.

RECEIVER PERFORMANCE CHECKS

Typical voltages given in the following performance checks are approximate readings and should be used only as a guide to the correct functioning of the equipment.

1. Carry out the following preliminary checks

   (a) Check that the d.c. resistance between the battery positive terminal and the negative line is not less than 3kΩ. (Avo 8 red lead to negative line)

   (b) Check that the compound resistance of the receiver circuit, i.e. from TR23 collector to the negative line, is not less than 1.5kΩ. (Avo 8 red lead to negative line)

   (c) Short circuit R51, rendering the squelch and battery economiser circuits inoperative.

   (d) Check that the battery voltage, on load, is 9.0V d.c.

   (e) Connect the multimeter in the battery positive supply line and with the VOLUME control at minimum, check that the total receiver current does not exceed 20mA.

2. Check the first local oscillator.

   Measure the voltage across R17 which should be as follows:-

   0.9V oscillating
   0.5V not oscillating

3. Check the second local oscillator.

   Connect the diode probe to the emitter of TR5 and check that the second local oscillator injection voltage is approximately 0.5V.

4. Check the a.f. sensitivity.

   Connect the a.f. oscillator, via a 10μF electrolytic blocking capacitor, to the top terminal of the VOLUME control RV1 and connect the audio output meter, set to 60Ω range to the earphone socket. Set the VOLUME control at maximum.

   Check that the a.f. signal level at 1,000 c/s required to give 50mW output is between 2.5 and 6mV.

   Disconnect the a.f. oscillator and electrolytic capacitor.

5 Check the i.f. sensitivity.

   Connect the signal generator to the base of TR2 via a 0.1μF capacitor and inject an unmodulated 10.7 Mc/s i.f. signal of 10μV. Holding the 10.7 Mc/s marker oscillator (PT501) close to the receiver first i.f. section, adjust the signal generator frequency for zero audio beat note. Remove the marker oscillator. Modulate the signal generator signal at 1000 c/s with 1.5 kc/s deviation (25 kc/s channel spacing) or 5 kc/s deviation (50 kc/s channel spacing). Note the reading on the audio output meter (db scale). Switch off the signal generator and again note the reading on the audio output meter.

   Check that a change in noise level of approximately 20db is obtained when the signal generator is switched on and off.

   Remove the signal generator and blocking capacitor.

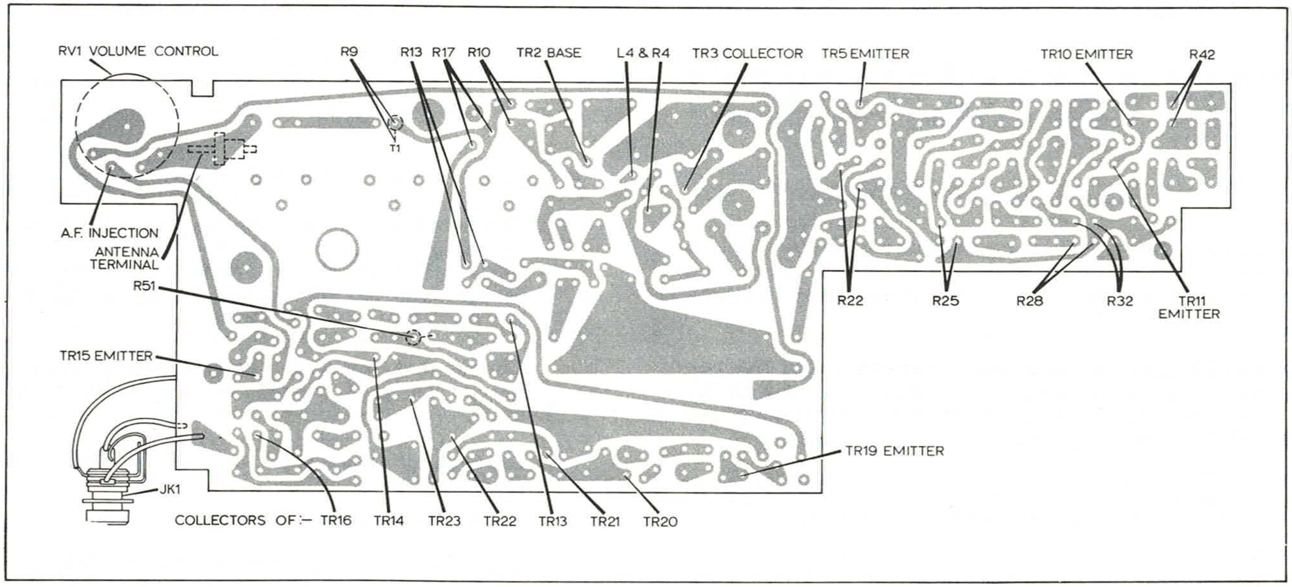


Fig. 9 Receiver Test Points

6. Check the overall sensitivity.

Connect the signal generator, set at the Receiver operating frequency, to the antenna terminal and inject an r.f. signal of 1μV modulated at 1,000 c/s with 1.5 kc/s deviation (25 kc/s channel spacing), or 5 kc/s deviation (50 kc/s channel spacing). Carefully adjust the signal generator carrier frequency to give maximum quieting and note the reading on the audio output meter (db scale). Switch off the signal generator and again note the db reading on the audio output meter.

Check that a change in noise level of 20db is obtained when the signal generator is switched on and off. Remove the audio output meter.

7. Check the squelch sensitivity.

Remove the short circuit across R51 so that the squelch and battery economiser circuit are operating.

Check that the receiver is silenced in the absence of a signal.

Check that the r.f. signal input required to just operate the squelch circuit is not greater than 1µV, modulated at 1,000 c/s with 1.5 kc/s deviation (25 kc/s channel spacing) or 5 kc/s (50 kc/s channel spacing).

Disconnect the signal generator.

8. Check the battery economiser circuit.

Check that the battery economiser circuit continues to operate when the squelch is closed, i.e. with no r.f. input signal, the change in battery current will be discernible on the multimeter (100mA range) connected in the positive supply line.

The needle will oscillate at a reading of approximately 8mA.

Check that the battery economiser circuit continues to operate when the battery supply voltage is reduced to 7.0V.

Note: The time constant of the battery economiser circuit can be checked by connecting the oscilloscope to the collector of TR23 and ascertaining that the ON/OFF periods are within the following limits.

ON	40 - 60 msecs
OFF	400-600 msecs

RECEIVER VOLTAGE ANALYSIS

Before carrying out the following voltage checks ensure that the battery supply voltage, on load, is 9.0V.

Short circuit R51 to maintain the battery economiser circuit in the ON condition.

The following, given in volts, is an indication of current being drawn by each stage.

1. Measure the d.c. voltage across the appropriate resistor.

Stage	Resistor	Typical Voltage
TR1	R9	0.7
TR2	R10	0.25
TR3	R4 and L4 in series	2.0
TR4	R13	0.2
TR6	R22	0.3
TR7	R25	0.8
TR8	R28	0.3
TR9	R32	0.3
TR12	R42	2.5

2. Measure the d.c. voltage between the negative line and each test point indicated.

Stage	Test Point	Typical Voltage
TR5	TR5 emitter	1.5
TR10 & TR11	TR10 & TR11 common emitter	0.4
TR13	TR13 collector	2.25
TR14	TR14 collector	5.0
TR15	TR15 emitter	0.22
TR16	TR16 collector	3.5
TR19	TR19 emitter	2.2
TR20	TR20 collector	0.1
TR21	TR21 collector	5.8
TR22	TR22 collector	8.7
TR23	TR23 collector	8.6

RECEIVER FAULT FINDING

Although a number of receiver faults may be located using standard techniques, it is essential that the circuit operation is clearly understood before attempting to localise a fault.

Most of the receiver noise, required to operate the battery economiser circuit, is produced in the first mixer stage and subsequently amplified by the 10.7 Mc/s and 100 kc/s i.f. stages. Sufficient noise is produced and applied to the base of the squelch rectifier for the positive going pulses to cause the squelch rectifier TR14 to bottom. With TR14 conducting, the audio stages are silenced and the battery economiser circuit switches the supply to the receiver circuit alternately on and then off. The operation of the transistor switch in the battery economiser circuit produces a soft audible click from the loudspeaker.

If a receiver fault causes a loss in gain, sufficient to reduce the noise level below that required to operate the Schmitt trigger circuit (TR10 and TR11), the noise output from the integrator circuit (TR12) fails completely. The squelch lifts and the battery economiser circuit latches on. As the Schmitt trigger is not operating, the receiver is effectively silenced and noise will not be heard in the loudspeaker.

Therefore any receiver fault causing a drastic loss of gain may appear as a transistor switching fault, i.e. the receiver is silent and the battery economiser circuit does not operate.

If the battery economiser circuit is cycling correctly most of the receiver stages must be working satisfactorily.

Procedure

Reduce the supply voltage to 7.0V and audibly check that the battery economiser circuit is operating.

If the economiser circuit is operating it must be presumed that the fault is in the R.F., 1st Local oscillator, Squelch rectifier or Audio stages and should be located using standard techniques.

If the economiser circuit is not operating, check the Battery Economiser, Squelch, Integrator and Schmitt trigger circuits.

Battery Economiser

1. Short circuit the base of TR19 to the negative line. If the battery economiser circuit does not function correctly, the fault is within the transistor switching circuit or is due to the receiver circuit drawing excessive current i.e. greater than 30mA.

2. Short circuit R51 and check the transistor switching circuit in the ON condition as follows:-

   (a) Check that the voltage across the collector and emitter of TR23 is between 0.1 and 0.5V.

   A zero voltage reading indicates that TR23 is faulty and this transistor should be replaced.

   WARNING

   A d.c. short circuit from the collector of TR23 to the negative line will destroy the transistor.

   (b) Check that the voltage between the base of TR21 and the negative line is less than 0.2V.

Squelch Circuit

1. Check that the noise voltage, observed on an oscilloscope, at the base of TR13 is approximately 40mV peak-to-peak.
2. Check that the noise voltage, observed on an oscilloscope, at the base of TR14 is approximately 2V peak-to-peak. With this noise level TR14 should bottom and the battery economiser circuit function correctly.

Integrator

The noise or signal output from the Schmitt trigger circuit causes the integrator stage to draw current.

Check the current drawn by the integrator TR12, by measuring the voltage across R42 which should be as follows:-

With Schmitt trigger operating	2.0V
With Schmitt trigger not operating	0V

A zero voltage reading across R42 therefore indicates that the fault is in the integrator or previous stage.

Schmitt Trigger

This stage is triggered by pulses applied to the base of TR10.

Connect an oscilloscope to the output of the Schmitt trigger circuit at the collector of TR11 and check that the Schmitt trigger is functioning correctly.

If there is no output from the Schmitt trigger circuit check that the noise amplitude at the base of TR10 is approximately 3V peak-to-peak.

RECEIVER OSCILLATOR ALIGNMENT

Alignment of the receiver first local oscillator does not form part of the normal alignment procedure. The Field Testing Procedure on page 1 is normally adequate for netting the equipments to the base station or re-aligning the oscillator if a component is changed in the oscillator circuit.

Oscillator alignment should only be carried out with test equipment of a high standard, the following direct reading instrument being recommended.

Marconi Frequency Meter TF 1417/2 with Converter TM7164

Detailed operating instructions are supplied by the manufacturer.

To align the receiver first local oscillator carry out the following procedure:-

Connect the live lead of the frequency meter to the junction L5/C14 (shown as point A in fig. 12) and the ground lead of the frequency meter to the printed circuit board negative line (shown as point B in fig. 12)

Connect a d.c. voltmeter across R17. Adjust L3 for a maximum reading (approx. 0.9V). Adjust L2 until the correct oscillator frequency is obtained.

The receiver first local oscillator crystal frequency is as follows:-

Carrier Frequency - 10.7 Mc/s

PARTS LIST

Grid ref.	Code	CAPACITORS				Part No.
W3	C1	2.2nF	Disc microcap			PN34302
R3	C2	8.5pF	Variable			PV05123
T24	C3	2.2pF	Ceramic	±0.25pF		PN01049
T5	C4	100pF	Ceramic			PN17037
N11	C5	0.3pF	Ceramic	±0.1pF		PN00012
R9	C6	8.5pF	Variable			PV05123
Q22	C7	15pF	Ceramic	± 5%		PN10041
T27	C8	15pF	Ceramic	± 5%		PN10041
X8	C9	10nF	Disc microcap			PN50324
W16	C10	10nF	Disc microcap			PN50324
R15	C11	8.5pF	Variable			PV05123
T17	C12	1nF	Disc microcap			PN26328
S18	C13	70pF	Ceramic (Part of T2)	± 5%		PN16001
X23	C14	10nF	Disc microcap			PN50324
W23	C15	100pF	Ceramic	± 5%		PN17037
R21	C16	2.2nF	Disc microcap			PN34302
N20	C17	10nF	Disc microcap			PN50324
U23	C18	3.5-13pF	Variable			PV05122
W13	C19	22µF	Tantalum		10V	PS26061
W31	C20	120pF	Polystyrene	± 2%	125V	PQ08767
M13	C21	10nF	Disc microcap			PN50324
M19	C22	2.2nF	Disc microcap			PN34302
M17	C23	15pF	Ceramic	± 5%		PN10041
X35	C24	68pF	Polystyrene	±2pF	125V	PQ07813
X36	C25	33pF	Polystyrene	±2pF	125V	PQ06164
N49	C26	22µF	Electrolytic		10V	PS26061
X31	C27	10nF	Disc microcap			PN50324
N37	C28	10nF	Disc microcap			PN50324
P31	C29	27pF	Ceramic	± 5%		PN11128
T34	C30	70pF	Ceramic (Part of T3)			PN16001
Q35	C31	10nF	Disc microcap			PN50324
X39	C32	23pF	Ceramic	± 5%		PN12040

Grid ref.	Code	CAPACITORS (Cont.)				Part No.
W38	C33	10nF	Disc microcap			PN50324
R36	C34	1µF	Tantalum		35V	PS13067
S39	C35	2.2nF	Disc microcap			PN34302
U41	C36	1nF	Disc microcap			PN26328
Q38	C37	10nF	Disc microcap			PN50324
P42	C38	1µF	Tantalum		35V	PS13067
Q41	C39	2.2nF	Disc microcap			PS34302
S43	C40	100pF	Ceramic	± 5%		PN17307
R42	C41	1µF	Tantalum		35V	PS13067
T44	C42	100pF	Ceramic	± 5%		PN17037
X45	C43 ▲	1nF	Disc microcap			PN26328
R48	C44 ▲	47pF	Ceramic	± 5%		PN13118
X50	C45 ▲	0.1µF	Tantalum		35V	PS00012
S50	C46 ▲	10nF	Disc microcap			PN50324
W51	C47 ▲	10nF	Disc microcap			PN50324
K6	C48	0.1µF	Tantalum		35V	PS00012
K4	C49	0.1µF	Tantalum		35V	PS00012
K9	C50	4.7nF	Tubular		250V	PR09507
K12	C51	4.7nF	Tubular		250V	PR09507
J13	C52	4.7nF	Tubular		250V	PR09507
G14	C53	0.1µF	Tantalum		35V	PS00012
D5	C54	22µF	Tantalum		10V	PS26061
H4	C55	1µF	Tantalum		35V	PR13067
K1	C56	47nF	Tantalum		35V	PS00002
E1	C57	47nF	Tantalum		35V	PS00002
H1	C58	10µF	Tantalum		20V	PS23063
D7	C59	22µF	Tantalum		10V	PS26061
A1	C60	22µF	Tantalum		10V	PS26061
	C61		Not used			
A19	C62	10µF	Tantalum		20V	PS23063
A24	C63	10µF	Tantalum		20V	PS23063
B15	C64	3.3µF	Tantalum		15V	PS17208
S17	C65	1nF	Disc ceramic			PN26328
T11	C66	1nF	Disc ceramic			PN26328
G3	C67	1nF	Disc microcap			PN26328

PARTS LIST(Cont.)

Grid ref.	Code	RESISTORS				Part No.
P24	R1	680Ω	Composition	±10%	0.1W	NG68103
M23	R2	6.8kΩ	Composition	±10%	0.1W	PL22246
W4	R3*	82kΩ	Composition	±10%	0.1W	NG82303
		or 100kΩ	Composition	±10%	0.1W	NG10403
		or 120kΩ	Composition	±10%	0.1W	NG12403
		or 150kΩ	Composition	±10%	0.1W	NG15403
		or 180kΩ	Composition	±10%	0.1W	NG18403
		or 220kΩ	Composition	±10%	0.1W	NG22403
		or 270kΩ	Composition	±10%	0.1W	NG27403
		or 330kΩ	Composition	±10%	0.1W	NG33403
R22	R4	470Ω	Composition	±10%	0.1W	PL22232
	R5		Not used			
T24	R6	15kΩ	Composition	±10%	0.1W	NG15303
W17	R7	33kΩ	Composition	±10%	0.1W	PL22254
X17	R8	6.8kΩ	Composition	±10%	0.1W	PL22246
W9	R9	390Ω	Composition	±10%	0.1W	NG39103
X15	R10	270Ω	Composition	±10%	0.1W	PL22229
X19	R11	560Ω	Composition	±10%	0.1W	PL22233
N19	R12*	330kΩ	Composition	±10%	0.1W	NG33403
		or 390kΩ	Composition	±10%	0.1W	NG39403
		or 470kΩ	Composition	±10%	0.1W	NG47403
		or 560kΩ	Composition	±10%	0.1W	NG56403
		or 680kΩ	Composition	±10%	0.1W	NG68403
		or 820kΩ	Composition	±10%	0.1W	NG82403
		or 1MΩ	Composition	±10%	0.1W	NG10503
N13	R13	220Ω	Composition	±10%	0.1W	PL22228
M15	R14	1kΩ	Composition	±10%	0.1W	PL22236
W34	R15	39kΩ	Composition	±10%	0.1W	PL22255
U32	R16	150kΩ	Composition	±10%	0.1W	PL22262
U13	R17	100Ω	Composition	±10%	0.1W	PL22224
W37	R18	1kΩ	Composition	±10%	0.1W	PL22236
M30	R19	1.5kΩ	Composition	±10%	0.1W	PL22238
Q32	R20	6.8kΩ	Composition	±10%	0.1W	PL22246
P33	R21	33kΩ	Composition	±10%	0.1W	PL22254
S33	R22	270Ω	Composition	±10%	0.1W	PL22229
P35	R23	560Ω	Composition	±10%	0.1W	PL22233

Grid ref.	Code	RESISTORS (cont.)				Part No.
U40	R24*	330kΩ	Composition	±10%	0.1W	NG33403
		or 390kΩ	Composition	±10%	0.1W	NG39403
		or 470kΩ	Composition	±10%	0.1W	NG47403
		or 560kΩ	Composition	±10%	0.1W	NG56403
		or 680kΩ	Composition	±10%	0.1W	NG68403
		or 820kΩ	Composition	±10%	0.1W	NG82403
		or 1MΩ	Composition	±10%	0.1W	NG10503
P38	R25	1kΩ	Composition	±10%	0.1W	PL22236
T38	R26	1.5kΩ	Composition	±10%	0.1W	PL22238
R39	R27*	560kΩ	Composition	±10%	0.1W	NG56403
		or 680kΩ	Composition	±10%	0.1W	NG68403
		or 820kΩ	Composition	±10%	0.1W	NG82403
		or 1MΩ	Composition	±10%	0.1W	NG10503
		or 1.2MΩ	Composition	±10%	0.1W	NG12503
		or 1.5MΩ	Composition	±10%	0.1W	NG15503
		or 1.8MΩ	Composition	±10%	0.1W	NG18503
		or 2.2MΩ	Composition	±10%	0.1W	NG22503
		or 2.7MΩ	Composition	±10%	0.1W	NG27503
		or 3.3MΩ	Composition	±10%	0.1W	NG33503
P44	R28	390Ω	Composition	±10%	0.1W	PL22231
P42	R29	5.6kΩ	Composition	±10%	0.1W	PL22245
U42	R30	5.6kΩ	Composition	±10%	0.1W	PL22245
X44	R31	27kΩ	Composition	±10%	0.1W	PL22253
Q45	R32	390Ω	Composition	±10%	0.1W	PL22231
Q43	R33	5.6kΩ	Composition	±10%	0.1W	PL22245
W45	R34▲	33kΩ	Composition	±10%	0.1W	PL22254
X47	R35▲	10kΩ	Composition	±10%	0.1W	PL22248
R44	R36▲	10kΩ	Composition	±10%	0.1W	PL22248
X48	R37▲	470Ω	Composition	±10%	0.1W	PL22232
T45	R38▲	10kΩ	Composition	±10%	0.1W	PL22248
R46	R39▲	4.7kΩ	Composition	±10%	0.1W	PL22244
Q49	R40▲	10kΩ	Composition	±10%	0.1W	PL22248
S49	R41▲	10kΩ	Composition	±10%	0.1W	PL22248
W49	R42▲	1kΩ	Composition	±10%	0.1W	PL22236
T50	R43▲	470Ω	Composition	±10%	0.1W	PL22232
P46	R44	150Ω	Composition	±10%	0.1W	PL22226
U51	R45▲	470Ω	Composition	±10%	0.1W	PL22232

PARTS LIST (Cont.)

Grid ref.	Code	RESISTORS (cont.)				Part No.
K8	R46	1kΩ	Composition	±10%	0.1W	PL22236
K11	R47	2.2kΩ	Composition	±10%	0.1W	PL22240
H15	R48	470kΩ	Composition	±10%	0.1W	PL22268
E15	R49	10kΩ	Composition	±10%	0.1W	PL22248
H9	R50	1MΩ	Composition	±10%	0.1W	PL22272
J10	R51	33kΩ	Composition	±10%	0.1W	PL22254
E7	R52	4.7kΩ	Composition	±10%	0.1W	PL22244
G6	R53	33kΩ	Composition	± 2%	0.1W	PL22662
K3	R54	220kΩ	Composition	±10%	0.1W	PL22264
H3	R55	47kΩ	Composition	±10%	0.1W	PL22256
G4	R56	6.8kΩ	Composition	±10%	0.1W	PL22246
J1	R57	470Ω	Composition	±10%	0.1W	PL22232
B3	R58*	470kΩ	Composition	±10%	0.1W	NG47403
		or 560kΩ	Composition	±10%	0.1W	NG56403
		or 680kΩ	Composition	±10%	0.1W	NG68403
		or 820kΩ	Composition	±10%	0.1W	NG82403
		or 1MΩ	Composition	±10%	0.1W	NG10503
		or 1.2MΩ	Composition	±10%	0.1W	NG12503
		or 1.5MΩ	Composition	±10%	0.1W	NG15503
		or 1.8MΩ	Composition	±10%	0.1W	NG18503
		or 2.2MΩ	Composition	±10%	0.1W	NG22503
		or 2.7MΩ	Composition	±10%	0.1W	NG27503
C1	R59	27kΩ	Composition	±10%	0.1W	PL22253
G8	R60	390Ω	Composition	±10%	0.1W	PL22231
D8	R61	470Ω	Composition	±10%	0.1W	PL22232
B6	R62	2.7kΩ	Composition	±10%	0.1W	PL22241
B30	R63	250kΩ	Composition	± 2%	0.1W	PL22872
A30	R64	220kΩ	Composition	± 2%	0.1W	PL22871
A26	R65	10kΩ	Composition	±10%	0.1W	PL22248
B23	R66	100kΩ	Composition	±10%	0.1W	PL22260
B18	R67	100kΩ	Composition	±10%	0.1W	PL22260
B20	R68	12kΩ	Composition	±10%	0.1W	PL22249
D15	R69	100kΩ	Composition	±10%	0.1W	PL22260
A14	R70	6.8kΩ	Composition	±10%	0.1W	PL22246
A11	R71	12kΩ	Composition	±10%	0.1W	PL22249
A12	R72	56kΩ	Composition	±10%	0.1W	PL22257

Grid Ref.	Code	RESISTORS (cont.)				Part No.
D14	R73	10kΩ	Composition	±10%	0.1W	PL22248
U27	R74	2.7kΩ	Composition	±10%	0.1W	NG27203
	RV1	5kΩ	Variable			PL09021/1

(RV1 combined ON/OFF and VOLUME)

SEMICONDUCTORS

	†TR1	Transistor	BF180 with R3		AT10944
	TR2	Transistor	BF181		FV05156
	*TR3	Transistor	GM378B		FV08139
	†TR4	Transistor	BC118 with R12		AT10701/1
	TR5	Transistor	BC118		FV07766
	TR6	Transistor	BC118		FV07766
	†TR7	Transistor	BC118 with R24		AT10701/3
	†TR8	Transistor	BC113 with R27		AT10702/1
	TR9	Transistor	BC113		FV07769
	▲TR10	Transistor	BC113		FV07769
	▲TR11	Transistor	BC113		FV07769
	▲TR12	Transistor	BC113		FV07769
	TR13 to TR16	Transistor	BC113		FV07769
	TR17	Transistor	NKT713	matched pair	FV06447
	TR18	Transistor	NKT212		
	TR19 to TR22	Transistor	BC113		FV07769
	TR23	Transistor	2G306		FV07010
	TR24	Transistor	BC113		FV07769
U25	D1	Diode	1S44		FV09818
S40	D2	Diode	OA95		FV09327
T41	D3	Diode	OA95		FV09327
E6	D4	Zener diode	1S2068A		FV09632
B26	D5	Diode	SG22		FV07256

PARTS LIST(Cont.)

Grid ref.	Code	INDUCTORS	Part No.
R4	#L1	Antenna loop assembly (L1 and C2)	AT32957/3
R27	L2	Crystal trimming coil	AT31801/1
W27	L3	Trimming coil	AT31800/1
S22	L4	R.F. choke	FT05608
X23	L5	Multiplier loop	AT32957/2
T33	L6	R.F. choke	FT05608
R9	#T1	Loop assembly (C6 and one loop of T1)	AT10700/3
R15	#T1	Loop assembly (C11 and one loop of T1)	AT10700/3
R19	T2	10.7 Mc/s I.F. Transformer	AT31825/1
T35	T3	10.7 Mc/s I.F. Transformer	AT31825/2
		MISCELLANEOUS	
	LS	Loudspeaker	FC12035
	-	Battery 9V (rechargeable)	FB01266
	FL1	10.7 Mc/s Crystal filter (25 kc/s)	FC03219
		10.7 Mc/s Crystal filter (50 kc/s)	FC03208
M26	XL1	Crystal P63J (25 kc/s) Crystal P61J (50 kc/s)	Frequency to order
S31	XL2	Crystal P53J 10.8 Mc/s	
	-	Thin film circuit unit	FU00040
	-	Receiver printed circuit board	AT26732/2
	-	Receiver (complete unit)	AT04369/2
	-	Receiver (complete unit) with thin film circuit unit	AT04369/3

▲ Part of thin film unit on /3 version of receiver.

† These transistors require their own correct matching resistor. If the resistor only is faulty this item may be replaced by a resistor of identical value to that already fitted.

Items supplied as an assembly for ease of replacement.

*Components selected on manufacture

MECHANICAL ITEMS	Part No.
Battery support assembly	AT10675
Clip	QA00027
Battery door assembly	AT10481
clamp	BT15957
door	BR35058
pin	BT24654
pad	BT24608
Case front assembly	AT10477
clip	BT16554
foam gasket	BT24611/1
hinge	BT17882
spirol pin	QA08165
spring	BT26866
Case back assembly	AT10480
case back	BT33022/A
pad	BT24607
Lid assembly printed	AT10484A
Antenna plate assembly	AT10928
Foam gasket	BT24611/2
U.H.F. Receiver label	BT18415
Ident label (standard model)	BT18410
Ident label (Home Office model)	BT18467
Insulator	FJ00021
Jack socket assembly	AT10699
Tufnol washer (switch)	BT09665
Screws:-	
6 B.A. x 3/16" countersunk hd.	RW31003/C
6 B.A. x $\frac{3}{4}$" slotted head	RW51012/C
8 B.A. x 7/16" cheesehead	RY11007/M
10 B.A. x $\frac{1}{8}$" cheesehead	QJ06200/M
10 B.A. x $\frac{1}{4}$" cheesehead	QJ06204/M
Special screw	BT08187
Nuts:-	
8 B.A.	QA11008/M
10 B.A.	QA11010/M

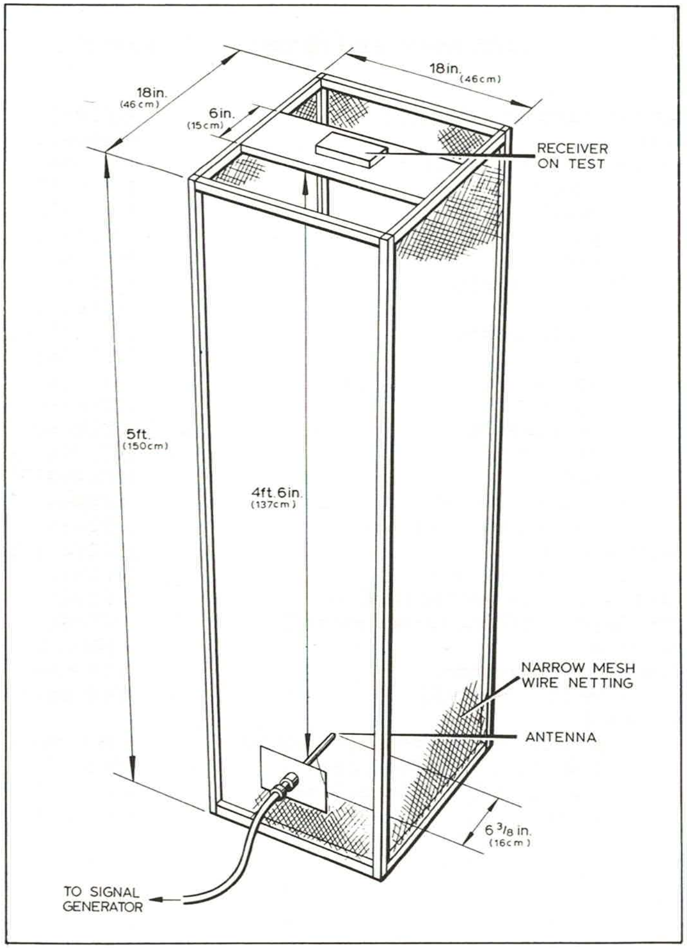


Fig. 10 Receiver Test Cage

Final Setting of the Antenna Trimmer

When the receiver antenna is reconnected, the antenna trimmer C2 must be realigned.

Body shielding and random reflection will effect the setting up of the squelch during the following procedure and therefore, whenever possible, setting up should be carried out using a fine mesh wire cage.

Connect a quarter wave antenna ($6\frac{3}{8}$ in. long) to the signal generator output and mount in a ground plane at a distance of approximately $4\frac{1}{2}$ feet from the Pocketfone receiver.

1. Carry out a comparative test using a known good Pocketfone receiver. With the signal generator set to the receiver operating frequency ascertain the minimum signal generator output required to operate the squelch.

2. Set the signal generator to the operating frequency of the receiver being realigned and ascertain the signal generator output required to operate the squelch.

   Adjust C2 and slowly reduce the signal generator output, in alternate steps, until the most sensitive squelch setting is obtained. Compare signal generator output reading with that obtained when checking known good receiver (see 1 above).

RECEIVER ALIGNMENT

Preliminary Procedure

Check that the battery supply voltage, on load, is 9.0V d.c.

Short circuit R51 to maintain the battery economiser circuit in the ON condition.

Connect the audio output meter, set to 60 Ω range, to the earphone socket.

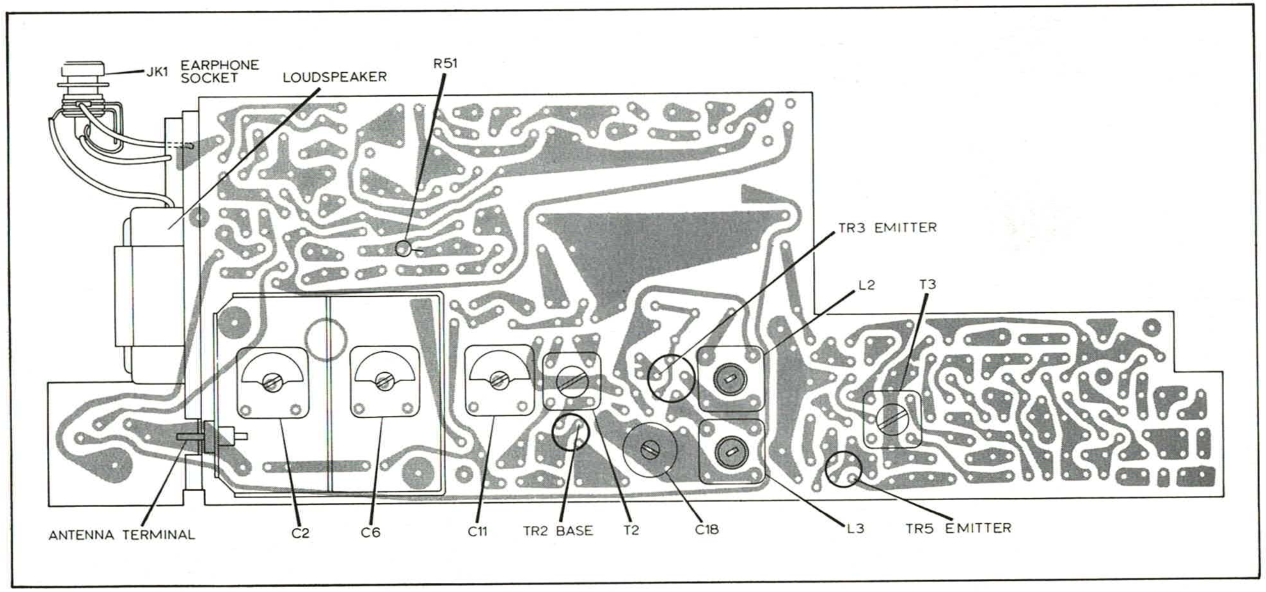


Fig. 11 Receiver Alignment - Component Location Diagram

Alignment Procedure

Connect the diode probe to the emitter of TR5.

Check that the second local oscillator injection voltage is approximately 0.5V.

Remove the diode probe.

Connect the signal generator at carrier frequency to the base of TR2.

Hold the 10.7 Mc/s marker oscillator close to the receiver first i.f. section.

Carefully adjust the signal generator frequency until a zero beat note is obtained.

Remove the marker oscillator.

Adjust T2 and T3 alternately for maximum quieting.

Disconnect the antenna and transfer the signal generator to the antenna terminal.

Inject an r.f. signal at the Pocketfone receiver operating frequency modulated at 1,000 c/s with 1.5 kc/s deviation (25 kc/s channel spacing) or 5 kc/s deviation (50 kc/s channel spacing).

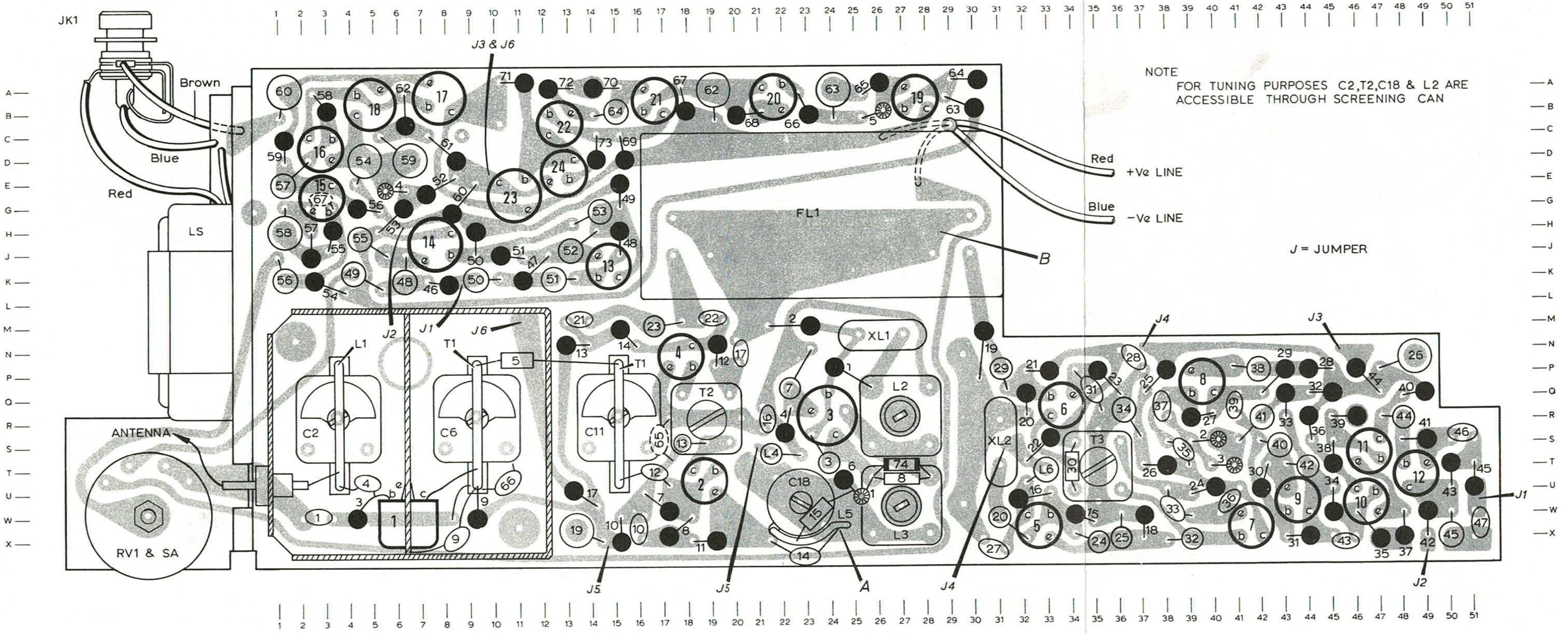
Adjust C2, C6, C11 and C18, in sequence for maximum quieting, reducing the signal level to the minimum required to maintain a working reading on the audio output meter.

Check the receiver for satisfactory operation when the battery supply voltage, on load, is reduced to 6.5V.

Remove test equipment. Reconnect the antenna and carry out the final setting of the antenna trimmer C2 (see Page 19).

Carry out the Field Testing Procedure (see Page 1) and adjust the crystal trimmer L2 for zero beat note.

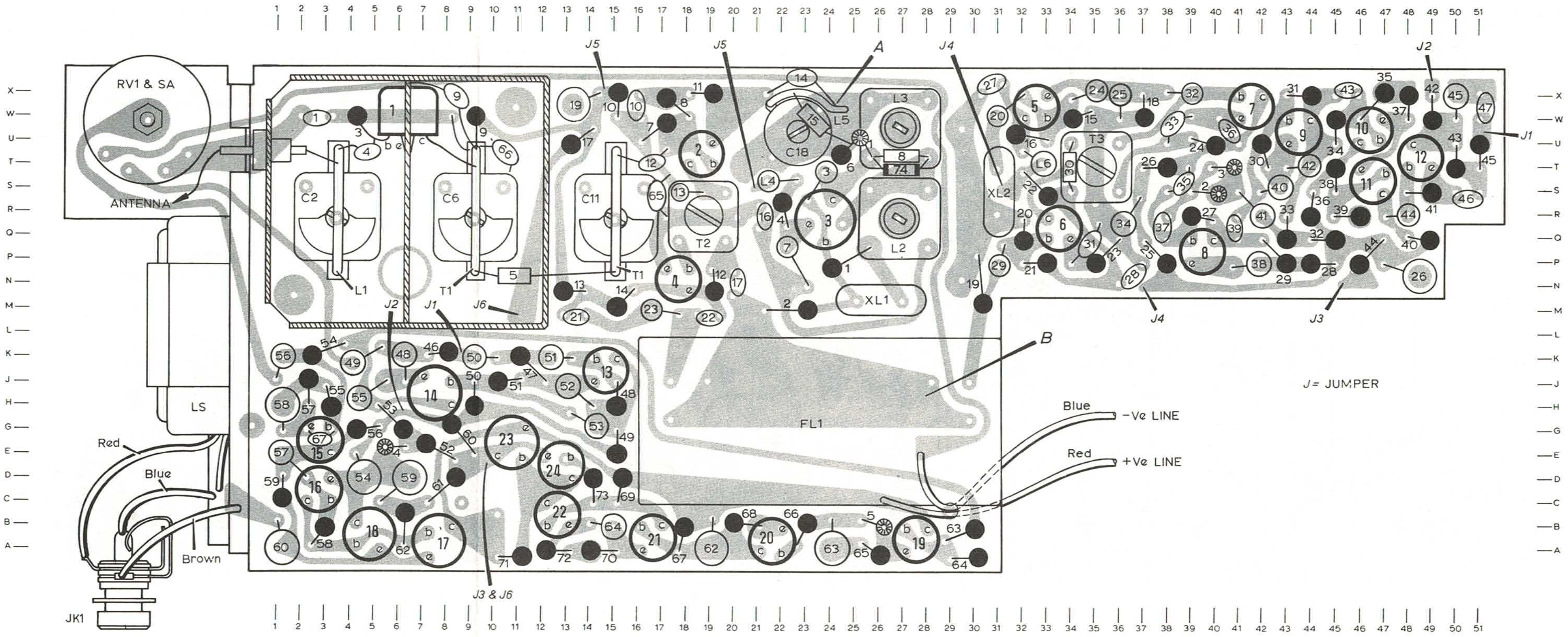
Carry out the Receiver Performance Checks (see Page 10).



NOTE
FOR TUNING PURPOSES C2,T2,C18 & L2 ARE ACCESSIBLE THROUGH SCREENING CAN

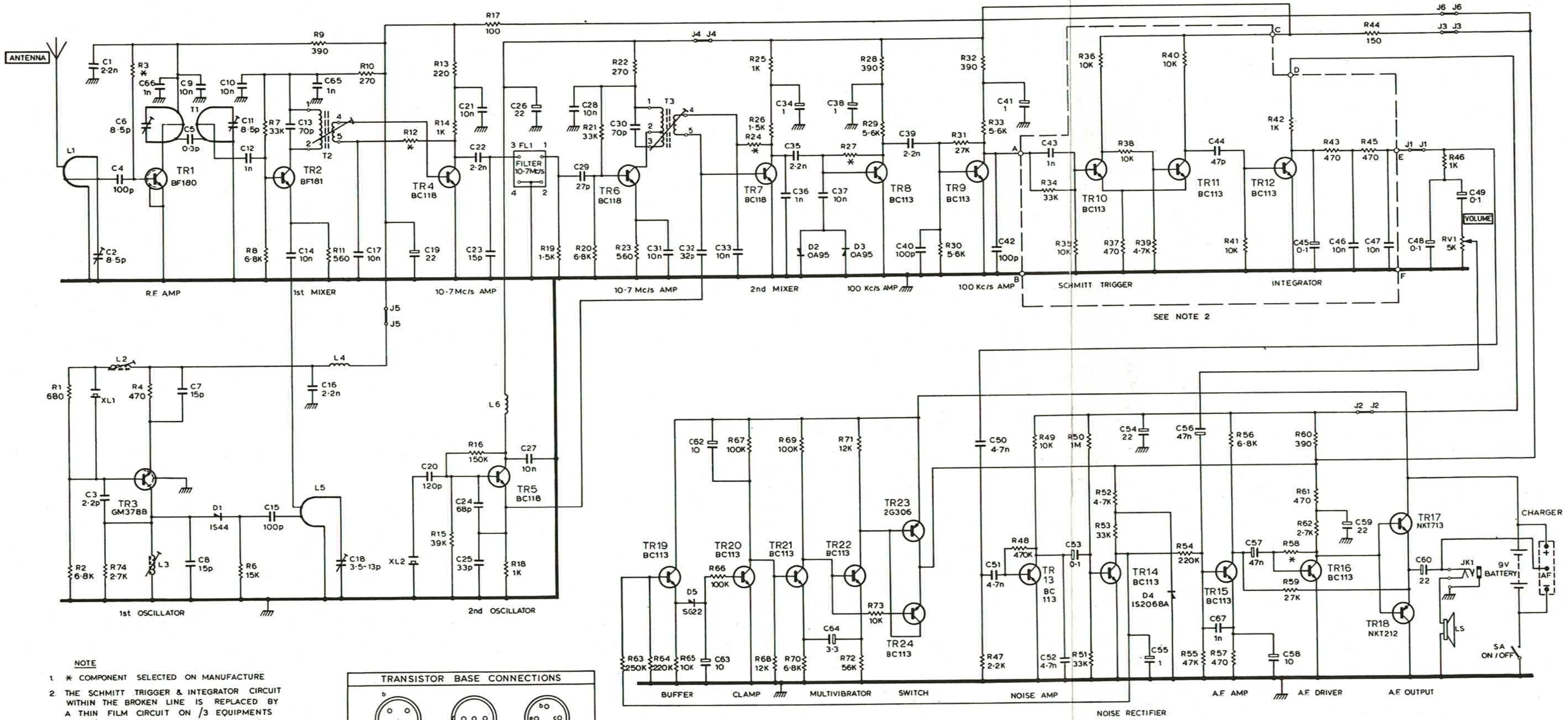
RESISTOR SYMBOL ▭ ● CAPACITORS PREFIX 'C' OR PLAIN OUTLINE DIODE SYMBOL ✺

Fig. 12 Pocketfone Receiver Component-Location Diagram (Top View)



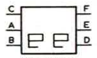
RESISTOR SYMBOL ▭ ● CAPACITORS PREFIX 'C' OR PLAIN OUTLINE DIODE SYMBOL ⊛

Fig. 13 Pocketfone Receiver Component-Location Diagram (Bottom View)



NOTE

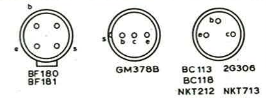
1. * COMPONENT SELECTED ON MANUFACTURE
2. THE SCHMITT TRIGGER & INTEGRATOR CIRCUIT WITHIN THE BROKEN LINE IS REPLACED BY A THIN FILM CIRCUIT ON /3 EQUIPMENTS THE CONNECTIONS FOR THIS CIRCUIT ARE SHOWN BELOW. FOR SERVICING DETAILS SEE APPENDIX



TOP VIEW

3. ⊸ DENOTES JUMPER

TRANSISTOR BASE CONNECTIONS



NOTE

TO LOCATE THE SCREEN PIN ON TRANSISTOR BF180 & BF181 CHECK FOR CONTINUITY BETWEEN SCREEN PIN AND OUTER CASE

Fig. 14 Pocketfone Receiver Circuit Diagram

POCKETFONE RECEIVERS INCORPORATING THIN FILM CIRCUIT

Introduction

Some models of the Pocketfone receiver have a thin film circuit. This is a sealed unit which replaces the existing Schmitt trigger, integrator and associated components.

Servicing

The thin film circuit unit shown within the dashed lines in the receiver circuit diagram in this manual is a sealed unit, repair or replacement of components within the unit is not possible. Therefore, before attempting to remove the unit it is extremely important to ensure that suspected faults within the unit are accurately diagnosed.

Before removing a thin film circuit unit from the receiver board the following measurements should be made using a 9V power supply, with R51 short circuited to render the squelch and battery economiser circuits inoperative.

1. D.C. voltage between Point C and negative line, typical value 8V.
2. D.C. voltage between Point D and negative line, typical value 7.6V.
3. D.C. voltage between Point A and negative line, typically 3.6V no signal or 1.2V with 100µV r.f. to antenna terminal.
4. A.C. voltage measured on an oscilloscope between Point A and negative line, typically 2V p-p no signal or 3.5V p-p with 100µV r.f. to antenna terminal.
5. D.C. voltage measured across points D and E, typical value 2.5V.
6. A.C. voltages measured between point E and negative line.
   - (a) With no signal typical value 0.5V p-p.
   - (b) With 100µV r.f. input unmodulated to antenna terminal, maximum value 40mV p-p.
   - (c) With 100µV r.f. input 1000 c/s modulation ±15 kc/s deviation (50 kc/s channel spacing) typical reading 250mV p-p or ±5 kc/s deviation (25 kc/s channel spacing) 80mV p-p.

If the values obtained (items 1-4) do not approximate to those given and the values under 5 and 6 are not obtained the unit should be replaced.

Remove the short circuit across R51 so that the squelch and battery economiser circuits can operate

Note

It is requested that faulty thin film circuit units be returned to the nearest Pye Service Depot.

Parts Lists

Referring to the receiver parts list the components affected are as follows:-

Delete:	TR10, TR11 and TR12 C43 to C47 R34 to R43 and R45
Add:	1 Thin Film Circuit Unit Part No. FU00040

TRANSMITTER UNIT

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Fig. 8 Transmitter Unit - Component Location Diagram

Fig. 9 Transmitter Unit Circuit Diagram

SUMMARY OF DATA

Service	F3 Telephony Two frequency working
Frequency range	450-470 Mc/s
Channel spacing	25 or 50 kc/s.
Power supply	One 18 volt battery (red)
Battery type	Rechargeable nickel cadmium battery
R.F. power output	100mW
Modulation	Peak deviation 5 kc/s (25 kc/s channel spacing) 15 kc/s (50 kc/s channel spacing)
Battery endurance	20 hrs. nominal (with 50 : 1 ratio)
Control	Press-to-talk switch
Antenna	Quarter wave six inch retractable
Dimensions	$6\frac{1}{16} \times 2\frac{5}{16} \times 1\frac{1}{8}$ in (15.4 x 5.85 x 2.85 cm)
Weights	Less batteries $7\frac{1}{2}$ oz (212 gm) With batteries $10\frac{1}{2}$ oz (298 gm)

OPERATING INSTRUCTIONS

Holding the transmitter unit with the base uppermost raise the battery door. Observing the locating key, insert the 18V battery (red) into the storage chamber and then close the battery door.

Operate the press-to-talk switch and, in conjunction with the base station, check the operation of the transmitter from various locations.

To obtain the best results from the Pocketfone transmitter it is essential that the transmitter unit is held with the microphone one or two inches from and a little to one side of the mouth. Speak in a normal conversational tone across the face of the microphone

FIELD TESTING PROCEDURE

Provided a marker oscillator, operating at the same frequency as that of one of the base station receiver intermediate frequencies is available, arrange for the base station engineer to check the Pocketfone transmitter frequency against that of the base station receiver.

1. Carry out operations 1, 2 and 3 of 'Dismantling Procedure'. Replace battery.
2. With the Pocketfone transmitter operating and radiating a carrier, arrange for the base station engineer to switch on the marker oscillator and hold it close to the appropriate mixer unit in the base station receiver.
3. If a high audio beat note is produced, the Pocketfone transmitter crystal trimmer C17 (Fig. 7) should be adjusted for zero beat.

TRANSMITTER CIRCUIT DESCRIPTION

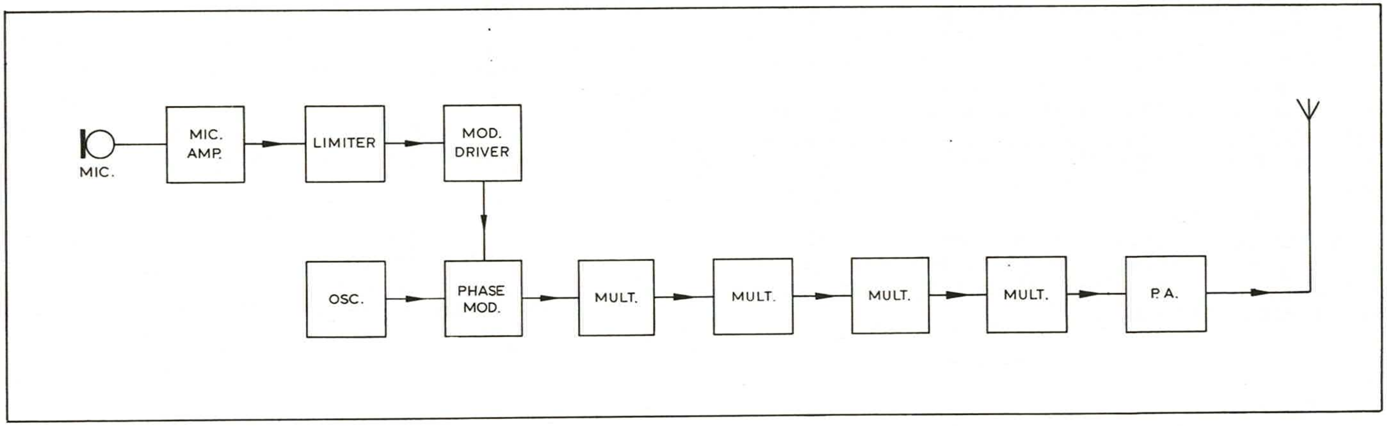


Fig. 1 Transmitter Block Diagram

CIRCUIT SUMMARY

The transmitter employs three transistors in the audio section and seven transistors in the r.f. section. The a.f. output from the microphone is amplified, limited and passed through a filter network before being coupled to the modulator driver stage.

The output from the crystal controlled oscillator circuit at the fundamental crystal frequency is frequency modulated by the a.f. output from the modulator driver stage.

After four stages of multiplication, the frequency modulated carrier is coupled to the single p.a. output transistor.

CIRCUIT DESCRIPTION

Audio Section

The a.f. output from the microphone is fed through a capacitor which, in conjunction with the input impedance of TR1 gives a pre-emphasis of approximately 6db per octave. It is then amplified by TR1 and TR2. TR2 also acts as a limiter, in conjunction with D1, to prevent the audio exceeding a pre-determined level.

The output of the limiter is then passed through the filter network to the base of TR3. R8 and C13 give a 6db per octave de-emphasis to compensate for the modulator characteristic. It should be noted that the modulator is in fact a phase modulator which has a 6db per octave pre-emphasis slope compared to a true frequency modulator, so that the 6db per octave de-emphasis circuit is built in to make the resultant approximate to frequency modulation. C8, R7, C10 form a low pass filter to reduce any audio component above 3 kc/s to an acceptable level.

The microphone itself has a very sharp cut off above 3 kc/s. R9 in the resistance capacity network determines the maximum frequency deviation of the carrier by the applied audio signal and is selected on manufacture to give a final peak deviation of 5 kc/s (25 kc/s channel spacing) or 15 kc/s (50 kc/s channel spacing).

The a.f. signal is coupled by C14 to TR3, the modulator driver stage, and the output from this stage which appears across R13 is connected to the emitter of the phase modulator TR5.

Since there is a total multiplication factor of 36, the peak deviation required at the phase modulator is less than 165 c/s for 25 kc/s channel spacing or 500 c/s for 50 kc/s channel spacing.

R.F. Section

The crystal oscillator circuit is provided with a capacitive trimmer C17, which is preset on manufacture.

The output from TR4, the crystal oscillator, is at the fundamental crystal frequency within the band 12.5 - 13.0555 Mc/s and is coupled by C24 to the modulator TR5.

When modulated, the output of TR5 is 180° out of phase with the base input so that the phase of the r.f. signal fed to the collector of TR5 via C25 varies with the modulation.

This stage is modulated by the audio applied to its emitter and the modulated signal is then fed to the 1st multiplier TR6 via the coupling capacitor C28.

After frequency multiplication in four tuned stages, the modulated carrier is coupled by C50 to the p.a. output transistor TR10. Note that the emitter and collector leads of TR10 are deliberately left long to provide matching of the input and output circuits.

Coupling to the quarter wave antenna is by the antenna loop L11

The stage by stage multiplication factors are as follows:-

TR4	x1
TR5	x1
TR6	x3
TR7	x3
TR8	x2
TR9	x2
TR10	x1
Total Multiplication	x36

Battery Supply

The operating supply is obtained from an 18V Deac nickel cadmium battery which is connected to the transmitter via the spring contacts of the battery support assembly and the press-to-talk switch.

The nominal supply voltage, measured with the equipment on load is approximately 16 volts, although fully charged batteries may be as high as 19 volts initially.

Replacement of the battery should be carried out when a deterioration in the transmitter performance is noted and will depend on the required operating range of the transmitter. In all equipments, however, the battery should be replaced when the on load voltage falls to 14V as the battery is then very near the end of its useful life.

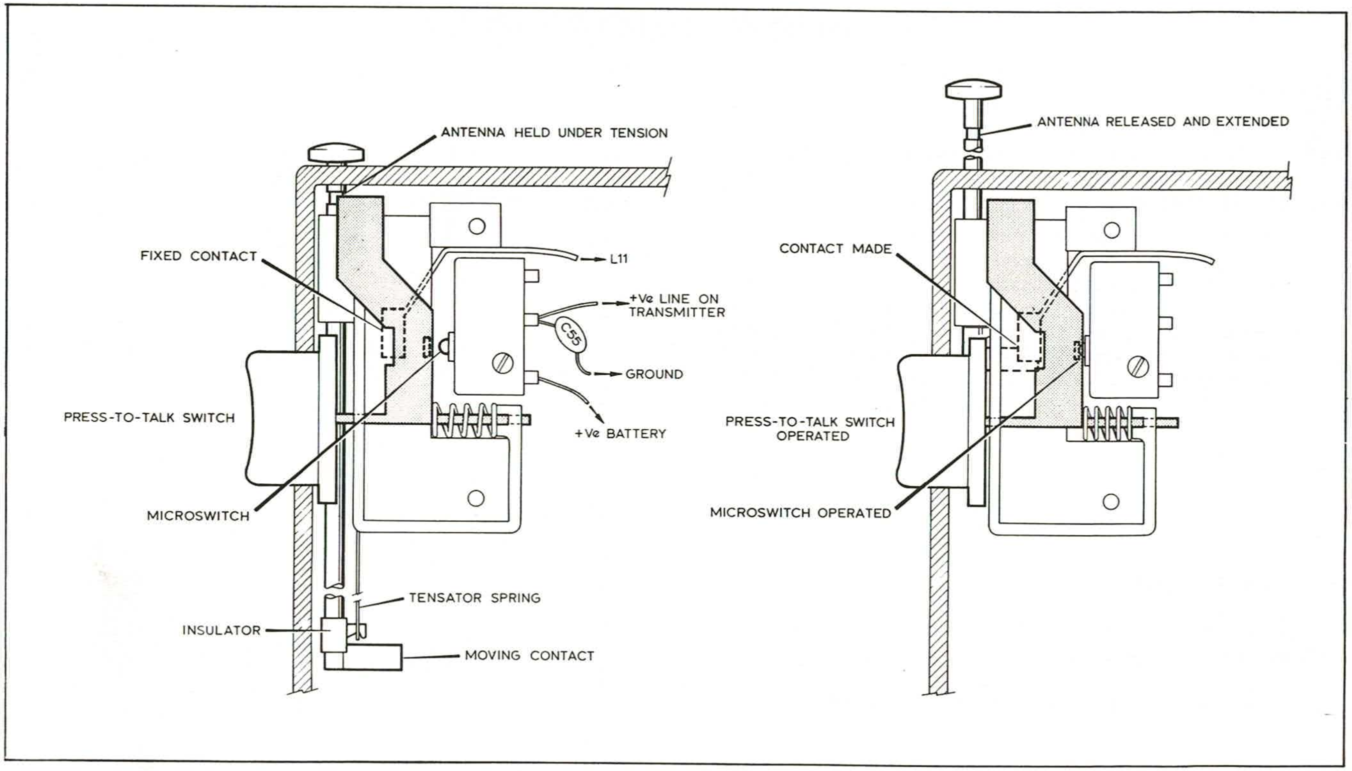


Fig. 2 Antenna Switch Mechanism

Antenna Switch Mechanism

Initial pressure applied to the press-to-talk switch actuates the antenna mechanism assembly. The antenna rod, which is under tension from its spring, is released and extends. At the end of its travel, the moving contact, located at the base of the antenna rod, mates with the fixed contacts and connects the antenna to the output from the transmitter.

Further pressure applied to the press-to-talk switch actuates the microswitch which switches the transmitter on.

TRANSMITTER SERVICING

Introduction

Due to the high component density, great care must be taken when removing or servicing Pye Pocketfone printed circuit boards.

It will not normally be necessary to remove the transmitter unit completely from its case to carry out performance checks or alignment. The printed circuit board can be raised at one end to take meter readings. If it is necessary to remove the screening can, the antenna feeder should be disconnected from the antenna coil and the chassis lifted clear of the case. It is not normally necessary to disconnect the battery leads or microphone.

Dismantling Procedure

1. Open the battery door and tilt the transmitter until the battery slides out.

2. Remove the two 6 B.A. slotted screws from the back cover.

3. Remove the front cover, taking great care not to damage components.

4. Disconnect the positive supply lead and the antenna feeder from the printed circuit board. Carefully raise the board, and disconnect the negative supply lead from the underside of the printed circuit board.

5. Gently lift the transducer from its mounting and then slide the printed circuit board, complete with transducer (microphone), from the back cover.

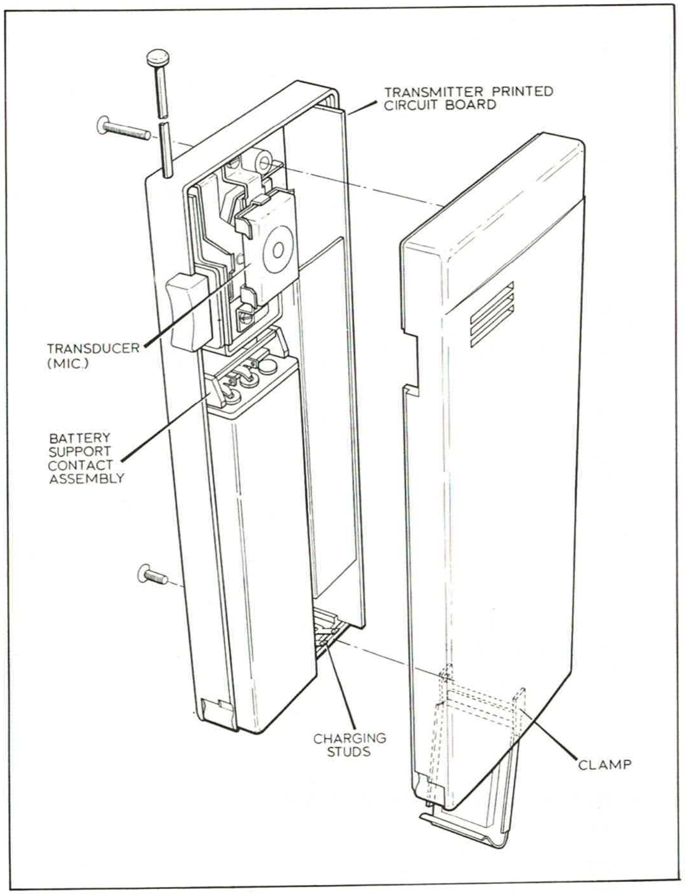

TRANSMITTER PRINTED CIRCUIT BOARD
TRANSDUCER (MIC.)
BATTERY SUPPORT CONTACT ASSEMBLY
CHARGING STUDS
CLAMP

Fig. 3 Transmitter Dismantling Diagram

Printed Circuits

When taking meter readings at appropriate points on the printed circuit board use needle point test probes. Use the minimum amount of force necessary when removing a faulty component. A recommended procedure is to cut the leads of the faulty components and holding the board upside down, apply the miniature soldering iron to the printed circuit board, thereby causing the end wires to fall out. A clean hot soldering iron must be used and soldering completed as quickly as possible to avoid damage caused by the softening of the adhesive under the printed circuit board.

Clean the end wires of the replacement component, insert through the holes in the board and then cut the end wires to length; should the holes be blocked with solder, a suction soldering iron, or suction pump may be used to assist in clearing the holes, and thereby avoid using excessive heat. Bend over against the printed circuit sufficient to hold the component in position and then complete soldering as rapidly as possible.

Plated through holes are used on the printed circuit board where components are connected to the negative line, thereby avoiding the soldering of component end wires to the top surface of the printed circuit board. The plated through holes are normally cleared by use of a suction soldering iron, but if this type of iron is not available carefully apply a miniature iron to the copper track surrounding the hole and insert a length of 26 s.w.g. enamelled copper wire to clear the hole.

Transistor Circuits

Transistors are susceptible to damage by current overload, reversed supply polarity or accidental short circuit. To avoid the risk of damage it is therefore advisable to use suitably insulated small test meter prods and crocodile clips.

As transistors are easily damaged when being removed, ensure that the transistor is faulty and not an associated component before removal.

TEST EQUIPMENT REQUIRED

1. Variable power supply unit giving hum-free d.c. supply (Solartron AS1164/2 or Farnell L20)
2. Multimeter of 20,000Ω/volt sensitivity (Avo Model 8).
3. A.F. oscillator with calibrated attenuator. (Marconi TF 1101)
4. General purpose oscilloscope.
5. H.F. valve voltmeter or diode probe (use circuit shown in fig. 6 with 0-50μA meter, or Pye TM1).
6. Deviation meter (Marconi TF791D)
7. R.F. power output meter for transmitter performance checks (Airmec 319).
8. R.F. power output indicator unit for transmitter alignment (use circuit shown or Pye TM1)
9. Pye PT.501 10.7 Mc/s Crystal Controlled Marker Oscillator.
10. Trimming Tools (Part No. ET16450 & ET16452).

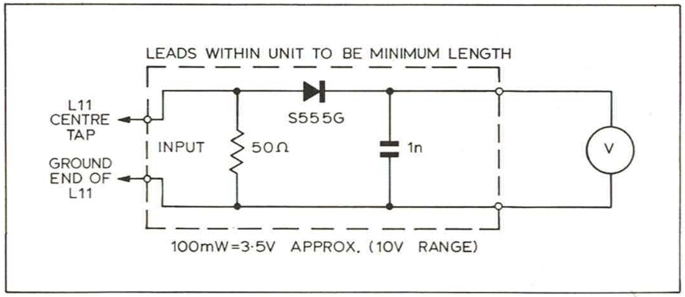

LEADS WITHIN UNIT TO BE MINIMUM LENGTH
L11 CENTRE TAP
GROUND END OF L11
INPUT
S555G
50Ω
1n
V
100mW=3·5V APPROX. (10V RANGE)

Fig. 4 R.F. Power Output Indicator Unit

PRECAUTIONS

Before servicing the transmitter carefully read the following notes:-

1. Ensure that the working surface is clear of tools or pieces of wire which might cause an accidental short circuit.

2. Always check the supply polarity before switching on the transmitter, as application of reverse supply polarity may destroy transistors.

3. After retuning an air spaced trimmer (C41, C47, C53, C56) seal the trimmer with locking dope.

4. If any nuts are tightened they should be sealed with locking varnish.

5. If the emitter of the p.a. transistor TR10 is inadvertently short circuited to the positive line, the transistor will be destroyed.

Note

The transistor case of TR10 and the adjacent tuned loop L8 are both connected to the battery positive.

6. Ground potentials which may exist between the soldering iron and test equipment or between different pieces of test equipment, can result in the unintentional application of damaging potentials to transistor electrodes. It is essential that all test equipment is adequately grounded and it is advisable to disconnect all test equipment from the transmitter before soldering.

7. Component failures may be caused by the use of excessive heat during soldering. Ensure that the surfaces to be soldered are clean before applying a clean soldering iron which has a small or pointed bit. Apply the minimum amount of heat consistent with making a good connection.

TRANSMITTER PERFORMANCE CHECKS

Typical voltages given in the following performance checks are approximate readings and should be used only as a guide to the correct functioning of the equipment.

1. With the transmitter switched on, check that the battery voltage is not less than 16 volts.

2. Check the power output.

   Connect the power output meter between L11 centre tap and ground connection to L11, ensuring that the free ends of the coaxial cable are as short as possible. Disconnect the antenna.

   Carefully adjust C47, C53 and C56 for maximum r.f. power output, which should be at least 80mW with 16V supply.

   After re-assembly, the transmitter PA trimmers should be adjusted for maximum radiated power. The Marconi Frequency Meter TF1026/1 is suitable. If a sufficiently sensitive indicator is not available a diode probe may be used with an antenna six inches long fitted to the probe.

   It should give a satisfactory reading when spaced at least 6 inches from the transmitter antenna. (The Pye TM1 may be used if the diode in the radiation meter circuit is S555G or equivalent).

   With the two fixing screws removed, open the case sufficiently to adjust the PA trimmers. Holding the set six inches or more from the radiation indicator, switch the transmitter on and adjust C56, C53 and C47 for maximum indication. Re-check all three trimmers and then close the case and replace the screws. Re-check the transmitter output.

3. Check the r.f. stages.

   If the transmitter r.f. output is low check the r.f. stages by measuring the d.c. voltage between the negative line and each of the following test points, the positions of which are shown in Fig. 5.

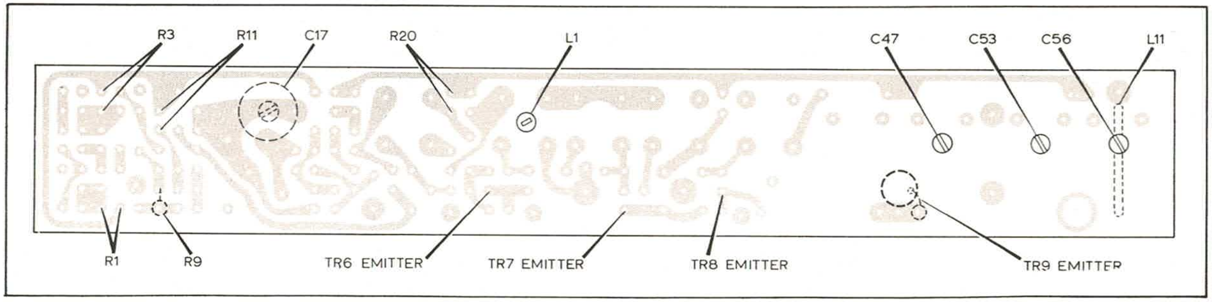


Fig. 5 Transmitter Test Points

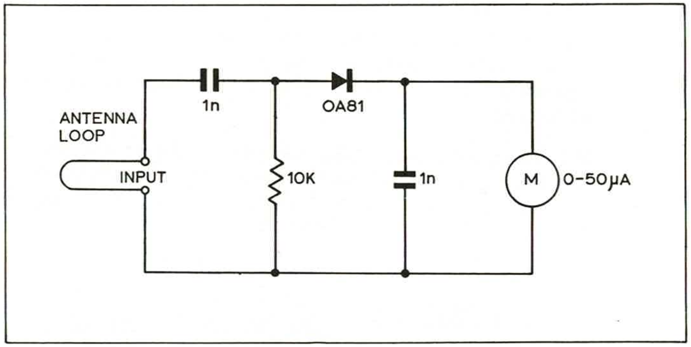


Fig. 6 Radiation Meter Circuit

Test Point	Typical Voltage
TR6 emitter	*0.25
TR7 emitter	*0.4
TR8 emitter	*0.7
TR9 emitter	1.5-2.0

*These readings are not mandatory and may vary between equipments

4. Check the modulator.

Connect the power output meter to the output tap of the antenna coupling coil L11 (see Fig. 5) and loosely couple the deviation meter to L11. Connect the a.f. oscillator across the microphone input and check that an a.f. input of approximately 100mV at 1,000 c/s gives the required peak deviation: 5 kc/s for 25 kc/s channel or 15 kc/s for 50 kc/s channel spacing. Slowly reduce the a.f. input until 3.5 kc/s deviation is obtained for 25 kc/s channel spacing or 7.5 kc/s deviation for 50 kc/s channel spacing and check that the a.f. input level is now 6mV ±3db.

Note: If the transmitter modulation only is being checked, (not the complete Transmitter Performance Checks) the deviation meter may be coupled to the transmitter antenna. The deviation meter must not be overloaded.

5. Using the Field Testing Procedure as detailed on page 1, check the Pocketfone operating frequency against that of the base station.

6. Check the carrier for hum or noise by listening on a monitor receiver or by monitoring the deviation meter output.

7. Check the modulation is normal.

Detailed Modulator Checks

1. Check the d.c. current drawn by the individual audio and modulator stages; measure the d.c. voltage across the collector resistors of each of the following transistors.

Stage	Test Point	Typical Voltage
TR1	R1	5.6
TR2	R3	8.0
TR3	R11	3.0
TR5	R20	4.7

2. Check the adjust of the modulator coil L1.

With the a.f. oscillator connected to the transducer (microphone) input adjust the a.f. signal level, at a constant frequency of 300 c/s, until 3 kc/s deviation (25 kc/s channel spacing) or 10 kc/s deviation (50 kc/s channel spacing) is obtained on the deviation meter.

With the oscilloscope connected to the deviation meter, adjust the core of the modulator coil L1 to obtain the best waveform. (The core of L1 should now be approximately level with the top of the coil former).

3. Check the limiter circuit.

With the oscilloscope connected to TR2 collector, adjust the a.f. signal level, at a constant frequency of 1,000 c/s, until the waveform at TR2 collector indicates that limiting has commenced. Limiting should occur at the top and bottom of the waveform with approximately the same a.f. signal level i.e. a peak to peak voltage of 14V. Increase the a.f. signal level by 20db and observe that the peak to peak voltage remains substantially constant.

4. Check the peak deviation.

With an a.f. input of 100mV at 1,000 c/s, check that the peak deviation, as measured on the deviation meter, does not exceed:

± 5 kc/s (25 kc/s channel spacing)
±15 kc/s (50 kc/s channel spacing)

Note

R9 is selected on manufacture to give the required peak deviation.

5. Check the a.f. response.

Adjust the a.f. signal level, at a constant frequency of 2.5 kc/s, until 4 kc/s deviation (25 kc/s channel spacing) or 12 kc/s (50 kc/s channel spacing) is obtained.

With a constant a.f. signal level, adjust the frequency of the a.f. input, and check that the deviation obtained at the selected frequencies corresponds to those given in the following table:-

	Deviation	
Frequency	25 kc/s ch. spacing	50 kc/s ch. spacing
6.0 kc/s	≏ 2.6 kc/s	≏ 8 kc/s
2.5 kc/s	4 kc/s	12 kc/s
1.0 kc/s	≏ 2.3 kc/s	≏ 7 kc/s
300 c/s	≏ 700 c/s	≏ 2 kc/s
100 c/s	≏ 300 c/s	≏ 1 kc/s

6. Check the audio sensitivity.

Check that the a.f. signal level required to give 50% modulation (±2.5 kc/s deviation 25 kc/s channel spacing or ±7.5 kc/s 50 kc/s channel spacing) is 6mV ±3db.

TRANSMITTER FAULT FINDING

To locate the faulty stage in a Pocketfone transmitter unit, carry out the following procedure.

Connect a testmeter Avo Model 8 (set to lowest appropriate mA range) in series with the battery supply (16V on load).

The following readings give an approximate indication of the current drawn under the conditions stated and assumes that all previous stages are correctly tuned.

Not oscillating	No Drive	11mA
Oscillating	No Drive	13mA
Drive applied to TR7		16mA
Drive applied to TR8		25mA
Drive applied to TR9		37mA
Drive applied to TR10		60mA

TRANSMITTER OSCILLATOR ALIGNMENT

Alignment of the transmitter oscillator does not form part of the normal alignment procedure. The Field Testing Procedure on page 1 is normally adequate for netting the equipment to the base station or re-aligning the oscillator if a component is changed in the oscillator circuit.

Oscillator alignment should only be carried out with test equipment of a high standard, the following direct reading instrument being recommended.

Marconi Frequency Meter TF1417/2 with
Converter TM 7164

Detailed operating instructions are supplied by the manufacturer but the following points should be noted.

(a) If the transmitter frequency is measured, the coupling between transmitter and frequency meter should be the minimum required to obtain a reading. In general, to avoid overloading the meter there should be no direct coupling and it may be necessary to separate the transmitter and meter by a few inches.

(b) The transmitter crystal frequency may be measured at the collector of TR4 if a high frequency counter is not available but care should be taken to avoid pulling the crystal frequency by keeping coupling to a minimum.

PARTS LIST

Grid ref.	Code	CAPACITORS				Part No.
H1	C1	1nF	Disc microcap	-20% +80%	30V	PN26328
E1	C2	4.7nF	Tubular		250V	PR09507
C1	C3	1nF	Disc microcap	-20% +80%	30V	PN26312
A3	C4	1nF	Disc microcap	-20% +80%	30V	PN26328
B3	C5	0.1µF	Tantalum		35V	PS00012
D3	C6	1nF	Disc microcap	-20% +80%	30V	PN26328
	C7		Not used			
G2	C8	4.7nF	Tubular		250V	PR09507
	C9		Not used			
G5	C10	4.7nF	Tubular		250V	PR09507
H7	C11	10µF	Tantalum		20V	PS23063
	C12		Not used			
D5	C13	47nF	Electrolytic		20V	PS00002
H8	C14	0.1µF	Electrolytic		35V	PS00012
	C15		Not used			
	C16		Not used			
G12	C17	3.5-13pF	Variable			PV05122
D13	C18	33pF	Polystyrene	±2pF	125V	PQ06164
G14	C19	10nF	Disc microcap	-20% +80%	30V	PN50324
B16	C20	510pF	Polystyrene	± 2%	125V	PQ11576
A15	C21	47pF	Polystyrene	±2pF	125V	PQ06888
E22	C22	10µF	Tantalum		20V	PS23063
G20	C23	10nF	Disc microcap	-20% +80%	30V	PN50324
D16	C24	0.1µF	Tantalum		35V	PS00012
G18	C25	220pF	Polystyrene	± 2%	125V	PQ10060
A19	C26	0.1µF	Tantalum		35V	PS00012
H25	C27	10nF	Disc microcap	-20% +80%	30V	PN50324
B22	C28	47pF	Tantalum	±2pF	125V	PQ06888
B20	C29	56pF	Ceramic	± 5%		PQ07311

Grid ref.	Code	CAPACITORS (cont.)				Part No.
G24	C30	56pF	Ceramic	± 5%	125V	PN14122
A24	C31	10nF	Disc microcap	-20% +80%	30V	PN50324
G30	C32	75pF	Silver mica	± 2%	350V	PQ08103
E29	C33	150pF	Silver mica	± 2%	350V	PQ09405
H23	C34	10nF	Disc microcap	-20% +80%	30V	PN50324
E33	C35	22pF	Polystyrene	±2pF	125V	PQ05618
B32	C36	10nF	Disc microcap	-20% +80%	30V	PN50324
B33	C37	10nF	Disc microcap	-20% +80%	30V	PN50324
E35	C38	5.6pF	Ceramic	±0.5pF		PN04142
H37	C39	10nF	Disc microcap	-20% +80%	30V	PN50324
G36	C40	30pF	Polystyrene	±2pF	125V	PQ06007
D42	C41	8.5pF	Variable			PV05123
H41	C42	1nF	Disc microcap	-20% +80%	30V	PN26328
A35	C43	1nF	Disc microcap	-20% +80%	30V	PN26328
B42	C44	10pF	Ceramic	± 5%		PN09047
H46	C45	1nF	Disc microcap	-20% +80%	30V	PN26328
H47	C46	1nF	Disc microcap	-20% +80%	30V	PN26328
D46	C47	8.5pF	Variable			PV05123
A44	C48	1nF	Disc microcap	-20% +80%	30V	PN26328
H55	C49	10nF	Disc microcap	-20% +80%	30V	PN50324
G47	C50	1nF	Disc microcap	-20% +80%	30V	PN26328
H50	C51	1nF	Disc microcap	-20% +80%	30V	PN26328

PARTS LIST (Cont.)

Grid ref.	Code	CAPACITORS (cont.)				Part No.
H49	C52	10μF	Electrolytic		20V	PS23063
D51	C53	8.5pF	Variable			PV05123
H52	C54	1nF	Disc ceramic	-20% +80%	30V	PN26328
on SA	C55	1nF	Disc ceramic	-20% +80%	30V	PN26328
D55	C56	8.5pF	Variable			PV05123

RESISTORS

A4	R1	5.6kΩ	Composition	±10%	0.1W	PL22245
A2	R2	2.7MΩ	Composition	±10%	0.1W	NG27503
	or	3.3MΩ	Composition	±10%	0.1W	NG33503
	or	3.9MΩ	Composition	±10%	0.1W	NG39503
	or	4.7MΩ	Composition	±10%	0.1W	NG47503
	or	5.6MΩ	Composition	±10%	0.1W	NG56503
	or	6.8MΩ	Composition	±10%	0.1W	NG68503
H3	R3	5.6kΩ	Composition	±10%	0.1W	PL22245
D2	*R4	1MΩ	Composition	±10%	0.1W	NG10503
	or	1.2MΩ	Composition	±10%	0.1W	NG12503
	or	1.5MΩ	Composition	±10%	0.1W	NG15503
	or	1.8MΩ	Composition	±10%	0.1W	NG18503
	or	2.2MΩ	Composition	±10%	0.1W	NG22503
	or	2.7MΩ	Composition	±10%	0.1W	NG27503
	or	3.3MΩ	Composition	±10%	0.1W	NG33503
	or	3.9MΩ	Composition	±10%	0.1W	NG39503
	or	4.7MΩ	Composition	±10%	0.1W	NG47503
C4	R5	390Ω	Composition	±10%	0.1W	PL22231
H14	R6	100Ω	Composition	±10%	0.1W	PL22224
H4	R7	4.7kΩ	Composition	±10%	0.1W	PL22244
C6	R8	22kΩ	Composition	±10%	0.1W	PL22252

Grid ref.	Code	RESISTORS (cont.)				Part No.
A6	*R9	100kΩ	Composition	±10%	0.1W	NG10403
	or	120kΩ	Composition	±10%	0.1W	NG12403
	or	150kΩ	Composition	±10%	0.1W	NG15403
	or	180kΩ	Composition	±10%	0.1W	NG18403
	or	220kΩ	Composition	±10%	0.1W	NG22403
	or	270kΩ	Composition	±10%	0.1W	NG27403
	or	330kΩ	Composition	±10%	0.1W	NG33403
	or	390kΩ	Composition	±10%	0.1W	NG39403
	or	470kΩ	Composition	±10%	0.1W	NG47403
	or	560kΩ	Composition	±10%	0.1W	NG56403
	or	680kΩ	Composition	±10%	0.1W	NG68403
A5	R10	82kΩ	Composition	±10%	0.1W	PL22259
E6	R11	1kΩ	Composition	±10%	0.1W	PL22236
B8	*R12	680kΩ	Composition	±10%	0.1W	NG68403
	or	820kΩ	Composition	±10%	0.1W	NG82403
	or	1MΩ	Composition	±10%	0.1W	NG10503
	or	1.2MΩ	Composition	±10%	0.1W	NG12503
	or	1.5MΩ	Composition	±10%	0.1W	NG15503
	or	1.8MΩ	Composition	±10%	0.1W	NG18503
	or	2.2MΩ	Composition	±10%	0.1W	NG22503
	or	2.7MΩ	Composition	±10%	0.1W	NG27503
	or	3.3MΩ	Composition	±10%	0.1W	NG33503
E7	R13	470Ω	Composition	±10%	0.1W	PL22232
B14	R14	27kΩ	Composition	±10%	0.1W	PL22253
E14	R15	27kΩ	Composition	±10%	0.1W	PL22253
G16	R16	1kΩ	Composition	±10%	0.1W	PL22236
R15	R17	1kΩ	Composition	±10%	0.1W	PL22236
C17	R18	3.3kΩ	Composition	±10%	0.1W	PL22242
H19	*R19	270kΩ	Composition	±10%	0.1W	NG27403
	or	330kΩ	Composition	±10%	0.1W	NG33403
	or	390kΩ	Composition	±10%	0.1W	NG39403
	or	470kΩ	Composition	±10%	0.1W	NG47403
	or	560kΩ	Composition	±10%	0.1W	NG56403
	or	680kΩ	Composition	±10%	0.1W	NG68403
	or	820kΩ	Composition	±10%	0.1W	NG82403

PARTS LIST (Cont.)

Grid ref	Code	RESISTORS			Part No.
A23	R21	2.2kΩ	Composition	±10% 0.1W	PL22240
C21	R22	22kΩ	Composition	±10% 0.1W	PL22252
H22	R23	1kΩ	Composition	±10% 0.1W	PL22236
B25	R24	100Ω	Composition	±10% 0.1W	PL22224
C30	R25	22kΩ	Composition	±10% 0.1W	PL22252
C29	R26	2.2kΩ	Composition	±10% 0.1W	PL22240
H35	R27	1kΩ	Composition	±10% 0.1W	PL22236
A34	R28	100Ω	Composition	±10% 0.1W	PL22224
E37	R29	100kΩ	Composition	±10% 0.1W	PL22260
C34	R30	2.2kΩ	Composition	±10% 0.1W	PL22240
H43	R31	470Ω	Composition	±10% 0.1W	NG47103
A37	R32	100Ω	Composition	±10% 0.1W	PL22224
H45	R33	100Ω	Composition	±10% 0.1W	NG10103
A45	R34	180Ω	Composition	±10% 0.1W	NG18103
	R35-R36		Not used		
H47	R37	10Ω	Composition	±10% 0.1W	NG10003

* Components selected on manufacture

SEMICONDUCTORS

†TR1	Transistor U15880/1with selected matching resistor R2	AT10945
†TR2	Transistor BC113 with selected matching resistor R4	AT10703/3
†TR3	Transistor BC113 with selected matching resistor R12	AT10703/5
TR4	Transistor BC118	FV07766
†TR5	Transistor BC118 with selected matching resistor R19	AT10701/5
TR6 to TR8	Transistor BF152	FV07758

Grid ref.	Code	SEMICONDUCTORS (Cont.)		Part No.
	TR9	Transistor	SE3002	FV07765
	TR10	Transistor	2N3866	FV07573
B4	D1	Diode	OA200	FV09303

INDUCTORS

E19	#L1	TR5 collector coil assembly (with C23 and C25)	AT31776/13
E25	#L2	TR6 collector coil assembly (with C27 and C30)	AT31775/13
E29	#L3	Coupling coil assembly (with C32 and C33)	AT31775/14
E33	#L4	TR7 collector coil assembly (with C35)	AT31777/13
E37	#L5	Coil assembly (with C38, C39, C40 and R29)	AT31777/14
D40	#L6	TR8 collector coil assembly (with C41)	AT10700/4
A43	L7	R.F. choke	AT31150/1
D46	#L8	Loop assembly (with C47)	AT10700/1
H48	L9	R.F. choke	AT31150/2
D51	#L10	Loop assembly (with C53)	AT10700/1
D55	#L11	Loop assembly (with C56)	AT10700/2

Transmitter Printed Circuit Board Assembly	AT26731/1
Transmitter (complete unit)	AT04368/2

PARTS LIST (Cont.)

MISCELLANEOUS	Part No.
Microphone (Transducer)	FM03519
Battery 18V (rechargeable)	FB01265
or	
Battery 9V (two required)	FB012262
Belt strap	BT27009

* Components selected on manufacture

† These transistors require their own correct matching resistor. If the resistor only is faulty, this item may be replaced by a resistor of identical value to that already fitted.

Items supplied as an assembly for ease of replacement.

MECHANICAL ITEMS	
Antenna mechanism assembly	AT26003
antenna rod assembly	AT26005
slider assembly	AT26004
support assembly	AT26006
can assembly	AT29351
cap top	BT16715
bobbin	BT01652
tensator spring	FS18073
helical spring	BT26863
microswitch (press-to-talk)	FS05707
microswitch plate	BT19480

MECHANICAL ITEMS (Cont.)	Part No.
Door assembly	AT10481
door	BT35058
clamp	BT15957
pin	BT24654
pad	BT24608
Case front assembly	AT10471
front cover	BT33019/A
Case back assembly	AT10472
back cover	BT33020
Battery support assembly	AT10676
Loop	BT18811
Bracket assembly (Transducer)	AT10473
Pad	BT24606
Pad	BT24623
Unit label (standard model)	BT18410
Unit label (Home Office model)	BT18467
U.H.F. Transmitter label	BT18416
Screws:-	
6 B.A. x 3/16" countersunk head	RW31003/C
6 B.A. x $\frac{3}{4}$'' slotted head	RW51012/C
8 B.A. x $\frac{1}{4}$'' cheesehead	RY11004/M
8 B.A. x $\frac{3}{8}$'' cheesehead	RY11006/M
10 B.A. x $\frac{1}{4}$'' cheesehead	QJ06204/M
10 B.A. x 5/16" cheesehead	QJ06205/A
Special	BT08187
Nuts:-	
10 B.A.	QA11010/M
6 B.A.	QA11206/M

TRANSMITTER ALIGNMENT

Preliminary Procedure

Disconnect the antenna and connect the power indicator unit (see Fig. 4) between the output tap and the ground connection of L11. To avoid mis-match the leads must be as short as possible. A coaxial lead of 50Ω impedance can be used provided the free ends are as short as possible.

Remove the batteries and connect the variable power supply unit, monitored with a 100mA meter in the positive supply line, to the battery contact assembly.

Connect the multimeter between the negative line and the test point indicated (unless otherwise stated in Alignment Procedure).

Although it is permissible to align the transmitter without the printed circuit board screening can, for fault finding purposes, the transmitter must be finally aligned with the screening can in position. Adjustment of the crystal trimmer C17 is made through the access hole in the screening can

If the transmitter is completely misaligned set the tuning cores and capacitors to pre-alignment positions as shown in Fig. 7. Carry out the following Alignment Procedure with the printed circuit board screening can in position.

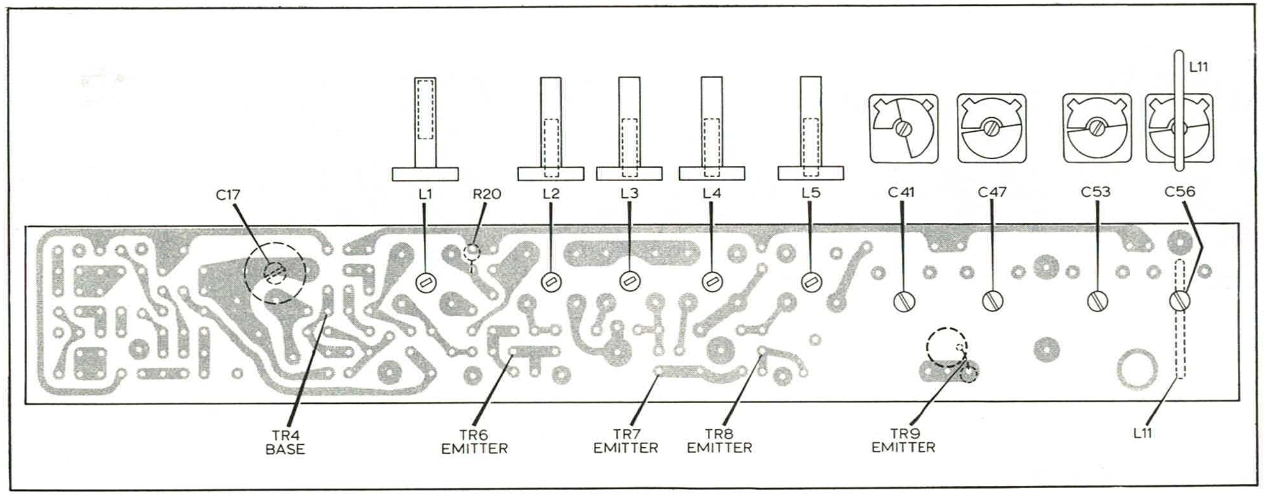


Fig. 7 Transmitter Alignment - Component Location Diagram

Alignment Procedure

Test Point	Procedure	Typical Reading
Across R20	Check modulator current	4.7V
TR6 emitter	Check modulator output	0.25V
TR7 emitter	Adjust L2 and L3 for maximum	0.4V
TR8 emitter	Adjust L4 and L5 for maximum	0.7V
TR9 emitter	Adjust C41 for maximum	
	Recheck L2, L3, L4, L5 and C41	1.8V
	Set C53 and C56 for minimum capacity	
	Adjust C47 for maximum on 100mA meter	
	Adjust C56 for maximum capacity	
	Adjust C53 for maximum power output	
	Adjust C56 for maximum power output	
	Carefully readjust C47, C53 and C56 for maximum r.f. power output	80mW minimum

Reduce the battery supply voltage, on load, to 14V d.c. and check that the r.f. output is at least 50mW.

Remove the test equipment and reconnect the antenna. Secure the printed circuit board to back cover.

Readjust C53 and C56 for maximum power output reading on a radiation indicator (or diode probe with quarter wave antenna).

Replace front cover and recheck the power output.

Carry out the Field Testing Procedure (see page 1) and adjust the crystal trimmer C17 for zero beat note as instructed by the base station engineer.

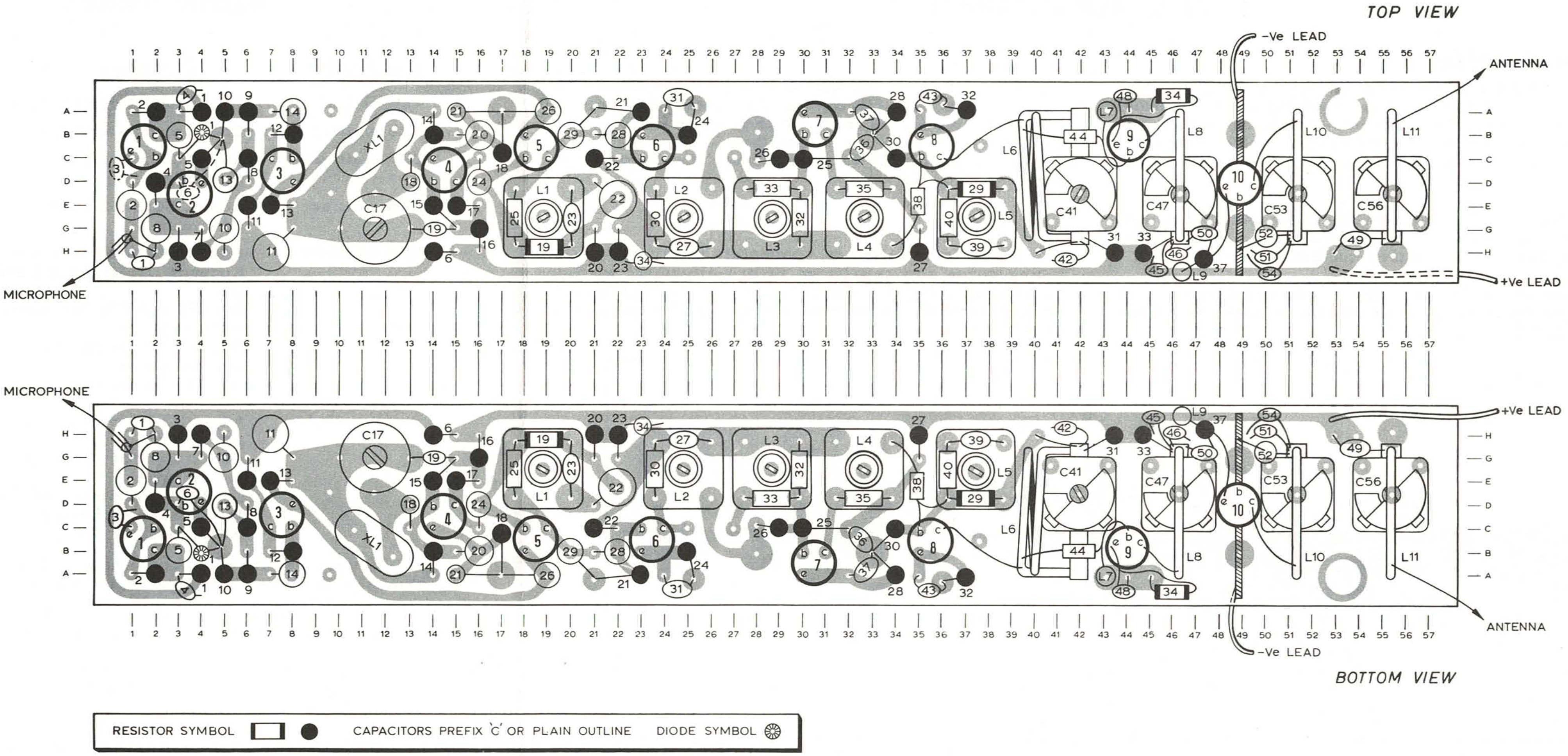
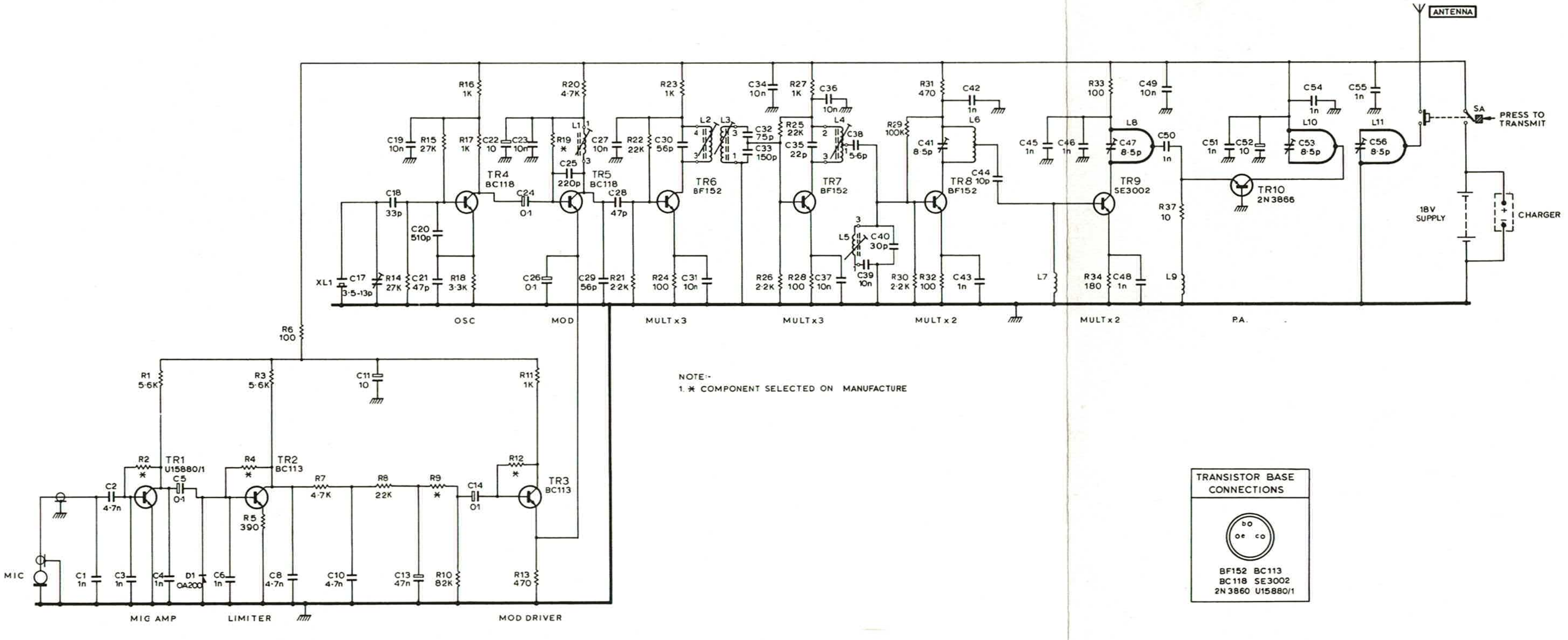


Fig. 8 Transmitter Unit - Component Location Diagram



NOTE:-
1. * COMPONENT SELECTED ON MANUFACTURE

Fig. 9 Transmitter Unit - Circuit Diagram